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ABSTRACT

The study discusses the problem of reporting program development costs and estimating service delivery cost. One adequate system is described. Based on field investigations, that system is compared with those of the National Institute of Education (NIE) career education projects. Chapter two contains a discussion of cost related concepts and chapter three specifies a framework for cost reporting of program development. It is suggested that costs be reported in a framework of the development activities and the products and subproducts of that activity. Chapter four discusses estimation of program service delivery costs. An exploratory and incremental estimate is suggested. Due to the difficulty of separating developmental from adopter activities and cost, an upper and lower estimate is utilized. Modifications to the cost collection and reporting system of chapter three are specified. These are in the direction of providing greater detail through specification of the components which describe the processes under development. Chapters five through seven compare the accounting systems of the three Experience Based Career Education (EBCE) models with that which evolved from chapters three and four. Chapter six encompasses the system of all four EBCE projects. Chapter eight contains conclusions, recommendations, and suggestions for future work. (Author/MW)

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DESIGN, ASSESSMENT, AND RECOMMENDATIONS FOR REPORTING EDUCATION PROGRAM RESEARCH AND DEVELOPMENT COSTS AND FOR ESTIMATING SERVICE DELIVERY COSTS OF PROGRAM ADOPTERS

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EXECUTIVE SUMMARY

Reporting program development costs requires that those activities which are significant be defined and costed. Some activities can be unambiguously traced to processes associated with developing the primary product(s), technique(s), and material(s) which define the objective of research and development projects. Such activities give rise to direct costs. Other activities are secondary to or supportive of those traced directly to the development process and give rise to indirect costs. Both kinds of activity should be defined, and resource allocation and cost should be traced to them. In Chapter Three, ten such activities are defined:

1. Design
2. Application
3. Evaluation
4. Product Finishing
5. Documentation
6. Replication/Diffusion
7. Fundor Negotiation and Liaison
8. Site Negotiation and Liaison
9. Staff Recruitment and Training
10. General Management, Housekeeping, and Clerical

These activities are sufficiently broad to apply to any development effort. They are recommended as Standard Cost Categories.

Costs should also be traced to the budgetary work units which characterize particular development projects. These should include the major research and development products. Where products are significant and complex, their component subproducts should be specified.

Collection of costs in the dimensions of Standard Cost Categories and of program products and their components makes possible the reporting of program development costs in terms of the research and development activities for each product and subproduct. Such a system will record the evolution of cost as products and subproducts move through developmental stages.

Such a system also provides the basic framework for constructing estimates of adopter resource requirements and of corresponding costs when the program is transferred from its developmental setting. The primary additional data collection requirement is expansion in the recording and reporting detail of product and subproduct resource requirements and costs. Each product/subproduct should be

described in terms of the major service components which compose it. The results of applying resources to each component of the program under development must be retained. Detail should be sufficient to distinguish between the costs of program acquisition tasks and program operations.

We recognize three possible levels of estimation complexity. The first and least complicated simply uses the record of developmental or field test experience, as collected above, to estimate adopter costs when the program is installed and operated at the same level of activity and with the same configuration of service components and treatment results which were present at the development site.

Second, adopters may wish to expand or contract the level of program activity while maintaining the same mixture and relative level of services and treatment results found at the development site. The problem here is that some resource requirements and costs will not change over some ranges of program activity level modification. These ranges over which resource requirements are invariant in response to output must be specified.

Finally, at a third level, the adopter may wish to modify the relative intensity, or mix, of different service and treatment components. To the problem just mentioned (invariance of fixed resource requirements) is added that of service component and treatment result interdependency. Because of the limited variety of program activity level and structure during development, estimates for the more complex circumstances require an increasing number of assumptions and an application of judgment.

In the initial formulation of this report,[1] ARIES suggested an upper and lower estimate of adopter cost. Such a procedure establishes a range of expected cost. This suggestion was made in recognition of the unknown degree to which Design and Evaluation activity continue in adopter settings, and is felt to provide a more realistic estimate than a single point estimate.

The initial report suggested that the lower estimate be based on the resources and cost of Application activity and that the upper estimate consist of Design and Evaluation activity in addition to that of Application. Based on subsequent work (see Appendix B) the range of variation between the lower and upper estimate of total annual costs would be the difference between $172,389 and $240,306, or

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1. February 22, 1974

$67,925 for EBCE at Northwest Regional Educational Laboratory (NWREL). This is a 39 percent difference. Such a range is judged to be excessive.

Therefore, the recommended calculation of the upper estimate is amended. Costs arising due to personnel primarily assigned to Design or Evaluation are to be excluded. The resources and costs of the Design and Evaluation activity of operational staff remains. This procedure results in an upper estimate of EBCE costs at NWREL of $212,851. This provides a more meaningful estimate of cost range in ARIES' view. Annual per pupil cost estimates of operational cost at various enrollments are reproduced from Appendix B in Chart I below.

Chart I

Estimates of Per Pupil Annual Costs at Various Enrollments

Item	Total Cost	Enrollments 50	64	75	100
Lower Estimate	$172,371	$3,446	$2,701	$2,585	$1,724
Upper Estimate	$212,851	$4,257	$3,326	$3,193	$2,129

The reader should refer to the Appendix for explanation and qualifications.

Estimates appropriate to each of two situations should be provided. The first is an exploratory estimate. This is applicable to early discussion and exploration of program adoption. This estimate is constructed by the agency providing information to the adopter. The estimate includes all, or nearly all, program resource requirements valued at wages, salaries and prices based on national adopter averages. The exploratory estimate is expressed in dollar terms.

If the exploratory estimate presents a range of cost which is acceptable to the adopter, his investigation will proceed further. The adopter will wish to refine the exploratory estimates to fit his circumstances. Wages, salaries and prices from national averages should be adjusted to those found in his locality. Any resources which can be provided to the program at no additional cost due to prior availability at the adopter site should be eliminated. This is especially likely for machinery and buildings. The estimate so constructed is the adopter incremental estimate.

The incremental estimates presented to the adopter should specify the kinds and types of resources required and the quantities of each allocated to the several elements of the program. Concern with physical quantities should precede application of monetary value in order to determine costs.

Construction of the data system for providing the resource quantities and costs should be undertaken early in the developmental process. Such a system would be based on a clear specification of the cost questions to be answered. The best possible estimates could then be provided. However, the contractors for present career education research and development programs have already been operating for an extended time. When their cost reporting systems are compared with the system developed in this report, significant discrepancies are noted as a general rule.

One of these is that secondary and supporting research and development activities are not fully reported. Another is that "operations" is not detailed sufficiently to fully describe program service components, and treatment results are not assigned to them.

With respect to describing the component structure of their programs considerable diversity exists among contractors even when the products under development are similar. One possesses a system which closely approximates the one we recommend. Another has little cost information beyond line item resource payment objects.

Considerable diversity also exists among contractors with respect to the assignment of the payment object to reporting categories and the procedures used when costs are prorated. Considerable diversity also characterizes the procedures for reporting staff time, the cost of which is the largest component of expenditure.

Contractors are willing to undertake additional calculations on the part of nondevelopmental staff in order to uniformly undertake cost allocation and proration. However, at this time, we feel there would be considerable resistance to those changes in the systems which record cost and resource allocation collection and which must be accommodated by developmental staff.

Therefore, we recommend that contractors immediately begin to provide upper and lower estimates of the acquisition and operational costs at incremental and exploratory levels. Full disclosure of data sources, measurement processes, assumptions and calculation procedures should be made explicit. This must start with statements of physical requirements for significant resources. By starting now problems can be identified and the appropriate changes made.

For purposes of exploratory estimates, we recommend adjustments for resource price differentials. This will require formation of national average wages, salaries, and prices for these same resources.

For incremental cost estimates, we recommend specification of the quantities of each of the resources for each of the program components in which they are employed.

This is admittedly a halfway house that stops short of presently imposing a more ideal system upon present contractors. However, even now, a more ideal system could not fully compensate for lost data concerning acquisition tasks which are not repeated. For most contractors, it will mean inability to assign costs to program service components and treatment results. The implication is that estimates of the cost effect of changes in program structure cannot be provided. Estimates for present activity levels and for program structure and extensions at changed activity levels with unchanged service can be. The advantage is that the estimation process can begin immediately. It will be a time consuming and arduous task. Should this process of estimation be found wanting, there may yet remain time for implementation of a better cost recording and reporting system, the need for which is then apparent.

Chapter One

INTRODUCTION

One of the most persistent problems of human service programs is that of cost reporting and estimation. This is true for programs whether in a developmental or the operational setting.

For programs under development there are three cost problems. The first is to report the costs of program development to fundors and sponsors in a form which is consistent with the structure of the budgeting process. The second is to report costs in a manner such that estimates of service delivery cost can be constructed for use when contemplating adoption of the program in an operational setting. A third problem is to assess the social value of the program in order to determine whether it is more or less efficient relative to alternatives, and whether and to what degree its benefits exceed costs.

These problems are not independent of one another. As listed they move from cost systems of less to those of more detail and scope. As we shall see, a cost reporting system adequate for estimation of operational service delivery costs on the basis of development experience can at the same time provide data required for the reporting of program development costs. Likewise a frequent criticism by those conducting effectiveness and benefit/cost studies of human service programs is that the cost record is inadequate to do so. Cost reporting for estimation of operational costs will contribute to rectifying that weakness.

This report concerns itself with the first two cost problems. Both of these treat costs similarly. In both problems the object of concern is expense. Both cost and transfer payments are included in expense. Also, the boundary of expense is the same for both. It is that of the funding or adopting agency. Expenses borne by third parties, directly or indirectly, are not included.

Most benefit/cost studies expand the boundaries of analysis from the fundor or adopter to include all economic units in the economy. If the program imposes a cost paid by third parties outside the fundor or adopter payment system, that cost is included by benefit/cost analysis. Such analysis also requires a persistent distinction between expense due to cost and that due to transfer payments. Also, costs may or may not be those actually paid by the economic unit. The relevant cost concept is opportunity cost, the value of the loss in satisfaction occasioned by choosing one alternative (the developed program) over the next best alternative. Due both to the requirement that all costs (for example, those of employers and students) be accounted for and to the definition of cost as opportunity cost, the analyst must frequently construct cost values which are adjusted for distortions in the price system. These may be other than those actually observed or paid. Due to these factors, this study does not include data reporting for benefit/cost analysis as a topic.

Therefore, the study discusses the problem of reporting program development costs and estimating service delivery costs. One adequate system is described. Based on field investigations, that system is compared with those of the NIE career education projects.

The remainder of the study proceeds as follows. Chapter Two contains a discussion of cost related concepts. Chapter Three specifies a framework for cost reporting of program development. We suggest that costs be reported in a framework of the development activities and the products and subproducts of that activity. Chapter Four discusses estimation of program service delivery costs. An exploratory and incremental estimate is suggested. Due to the difficulty of separating developmental from adopter activities and cost, an upper and lower estimate is utilized. Modifications to the cost collection and reporting system of Chapter Three are specified. These are in the direction of providing greater detail through specification of the components which describe the processes under development. Chapters Five through Seven compare the accounting systems of the three EBCE models with that which evolved from Chapters Three and Four. Of these, Chapter Six encompasses the system of all four Experience Based Career Education (EBCE) projects. Chapter Eight contains conclusions, recommendations, and suggestions for future work.

Chapter Two

COST DEFINITIONS AND CONSIDERATIONS

This is a cost study. Cost is of interest to individuals of widely different interests. It is the object of study by at least two professional groups, accountants and economists. Cost would seem a simple concept, but, in fact, it is a subject of much complexity. Numerous distinctions and issues abound. Economists and accountants speak a somewhat different language. Therefore, a short discussion of common cost definitions and problems would seem in order.

I: Origin and Definition of Cost

Cost starts with an economic unit[1] seeking to satisfy individual or group needs and wants. Doing so necessitates the use of labor, land, and capital (buildings, machinery, equipment, skills), and noncapital products or services. But products and services are themselves the result of applying land, labor, and capital in an organized manner. These essential requirements we call resources.

Resources are of three general kinds. Land and labor have been mentioned. The third is capital —physical in the case of buildings, machinery and equipment and human in the case of skills and other capacities which are developed and maintained.

One fundamental relationship is that which exists between the output of good or service produced or the need or want satisfied and the quantity of each of several resources required in order to achieve the given output. Technology is the concept which describes the body of knowledge of such production relationships.

As more of a product is produced, more of one or more resources will be required. This adjustment of resource quantity to output may be either continuous or discrete. For example, as more graduates are to be delivered from an educational system, the number of texts generally increases continuously with the number of graduates but the number of classrooms increase discretely. One more graduate requires at least one more set of instructional materials but not necessarily one more classroom. Resources which adjust only discretely with output and cannot be obtained in any desired quantity are said to have the characteristic of indivisibility. The contrast between divisible and indivisible resources is illustrated below.

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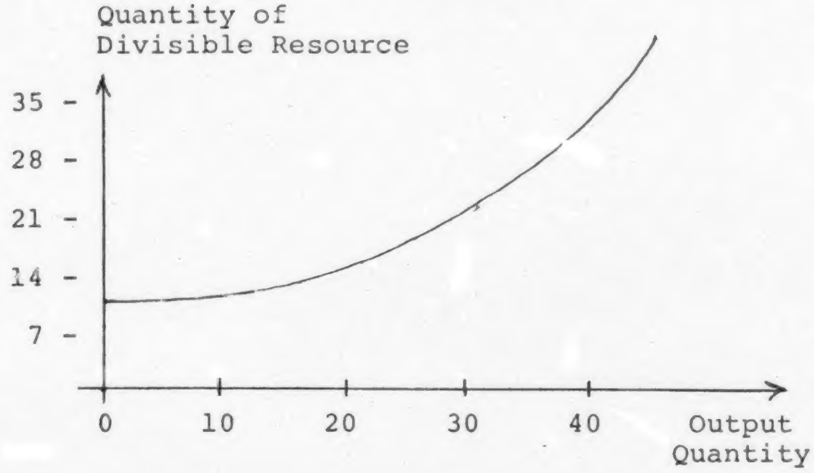
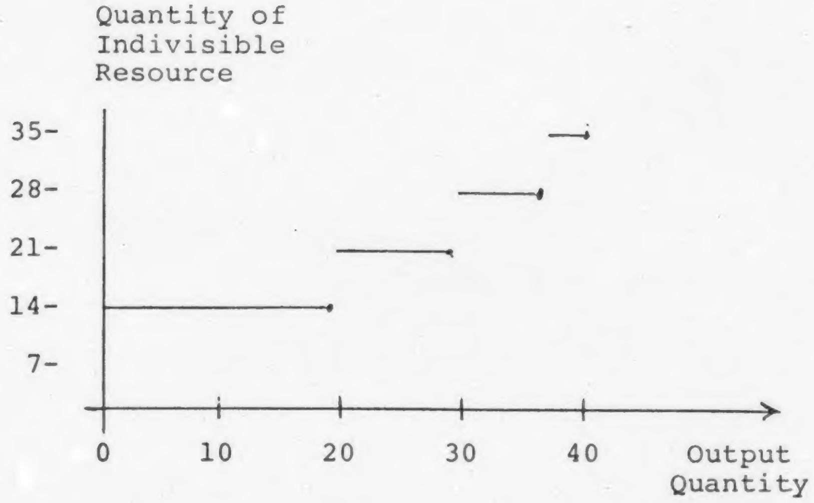
[1] In elementary or economic theory this unit is either a consumer, a producer, or a resource owner. These are functionally defined so that the same person or group may act as a producer or resource owner.

Divisible Resource



Indivisible Resource



Cost is associated with resource utilization because resources are limited. Their allocation to satisfying one need or want implicitly negates their use elsewhere. Thus, not all needs and wants can be simultaneously satisfied. This leads to resources being compensated. If present users do not provide sufficient rewards to the resources they employ, those users with deficient resources will offer inducements to attract additional quantities. These inducements may be objective in terms of products, services, or money, or subjective in terms of satisfaction itself. Regardless of the nature of inducement, its value will rise until present resource users are providing inducements greater than or equal to those which any denied but desirous user would be willing to offer.

This discussion is superficial and oversimplified but it does lead to a definition of cost. Cost is the value of the inducement which, if provided, would secure the continued voluntary allocation of desired quantities of a resource to an economic activity. Cost, while not identical to resource, is a function of its use.

II: Economic Value of Resource As Opportunity Cost

Since there are not enough resources to simultaneously satisfy all demands, allocating a resource to one activity denies it to another. The output, or result, of the excluded activity is thus lost to society. This leads to the economic value of a resource as opportunity (foregone) cost.

Opportunity cost is the highest value of alternative output, or results, lost due to the allocation of a resource to one activity and its corresponding denial to all others. The market price of a resource may or may not equal its opportunity cost.

III: Not All Payments Are Costs — Transfers

Cost as a payment is to be distinguished from a transfer. A transfer payment is a gift. A transfer is a payment made to an economic unit which is not a direct inducement or compensation as a consequence of the unit offering up resources under its command. No resource allocation is made and there is no lost production. Hence, there is no opportunity cost.

IV: Expenses and Costs Are Not Identical

Accountants discuss expenditures. An expenditure is any charge that results in the reduction of the net resources of the paying unit. In particular, transfer payments are expenditures of an expendable fund. Costs, of course, are also unless the particular economic unit avoids paying some cost as in the case of effects of pollution. That is, the payment to a resource may be less than, equal to, or greater than the true (economic) cost.

The only problem is that in many discussions expenditures become equated with cost and then clarity vanishes.

V: Cost and Expenditure

A. Fixed and Variable Costs

Economists divide costs into two kinds depending on the degree to which some resource requirements change when output is changed. The two broad categories are fixed cost and variable cost.

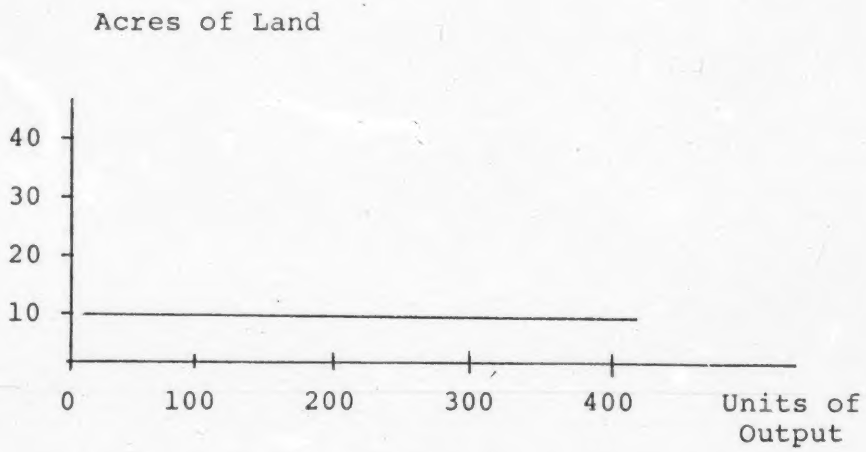
Some costs are fixed costs. These are costs which do not vary as the level of production is changed. The cost of a building employed in an economic activity[1] is usually a fixed cost. Costs are fixed because the resource quantity is fixed. Chart I below portrays the relation of fixed cost to output.

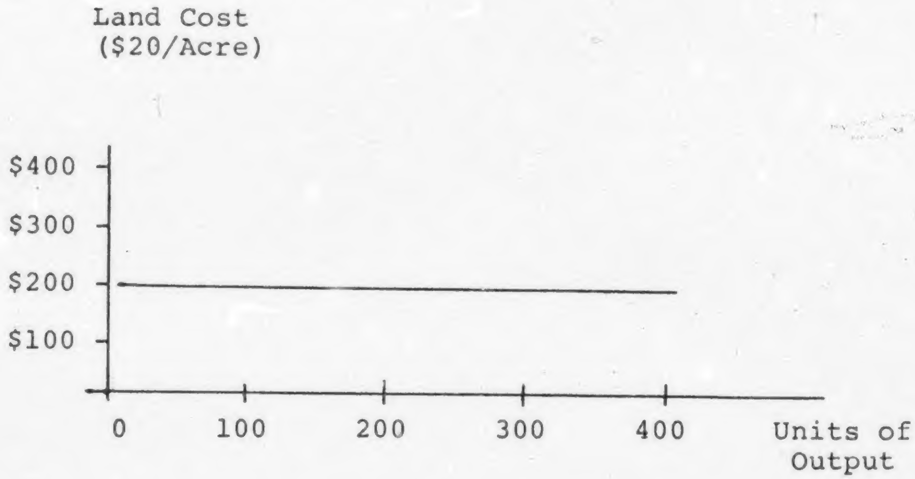
---

[1] There are two fundamental economic activities, production and consumption. Production is the transformation of resources and preexisting products into a product through the application of technology. (Technology is the knowledge which specifies the quantities of resources capable of producing each quantity of a given product. A production function specifies the minimum resource requirements for the given product and output.) Consumption is the direct transformation of products and/or resources into satisfaction of individual or group needs and wants.

Chart I

Fixed Resource Requirements and Cost





Start-up and Acquisition Costs Are Fixed Costs:

At this point, we may distinguish two different sources of fixed cost. For a new enterprise or for a new product of an old enterprise there are at least two elements.

These are (1) those costs (and resource allocations) which are necessarily incurred prior to the point of volume production of the product and (2) those which are incurred subsequently. Start-up costs are those which are incurred prior to the point of volume production. These costs have two elements: Capital costs for machinery, buildings, etc. are one component. These are treated as are other capital costs. They are spread over many time periods through depreciation. The remainder of start-up costs will be noncapital costs, labor and short lived materials, necessary to establish and perfect the production process. These costs are also spoken of as start-up costs. They present an issue to the accountant since there is no clear rule for their treatment; they may be charged to a single period or spread over several years.

Other writers have used terms other than start-up to refer to (the) costs which are due to the period prior to volume production. One we should mention is the term, acquisition costs. Acquisition costs are defined as the costs of all resources allocated in order to develop the capacity to produce some product or offer some service.

Almost all writers use the term operational costs to describe the sum of all costs which occur subsequent to the point of volume production.

Variable costs are the second cost category of which fixed cost was the first. Variable costs are those which change[1] when output changes. Energy costs are illustrative of variable costs. As more is produced, more energy is required and energy costs increase. Chart II below portrays the relation of variable cost to output.

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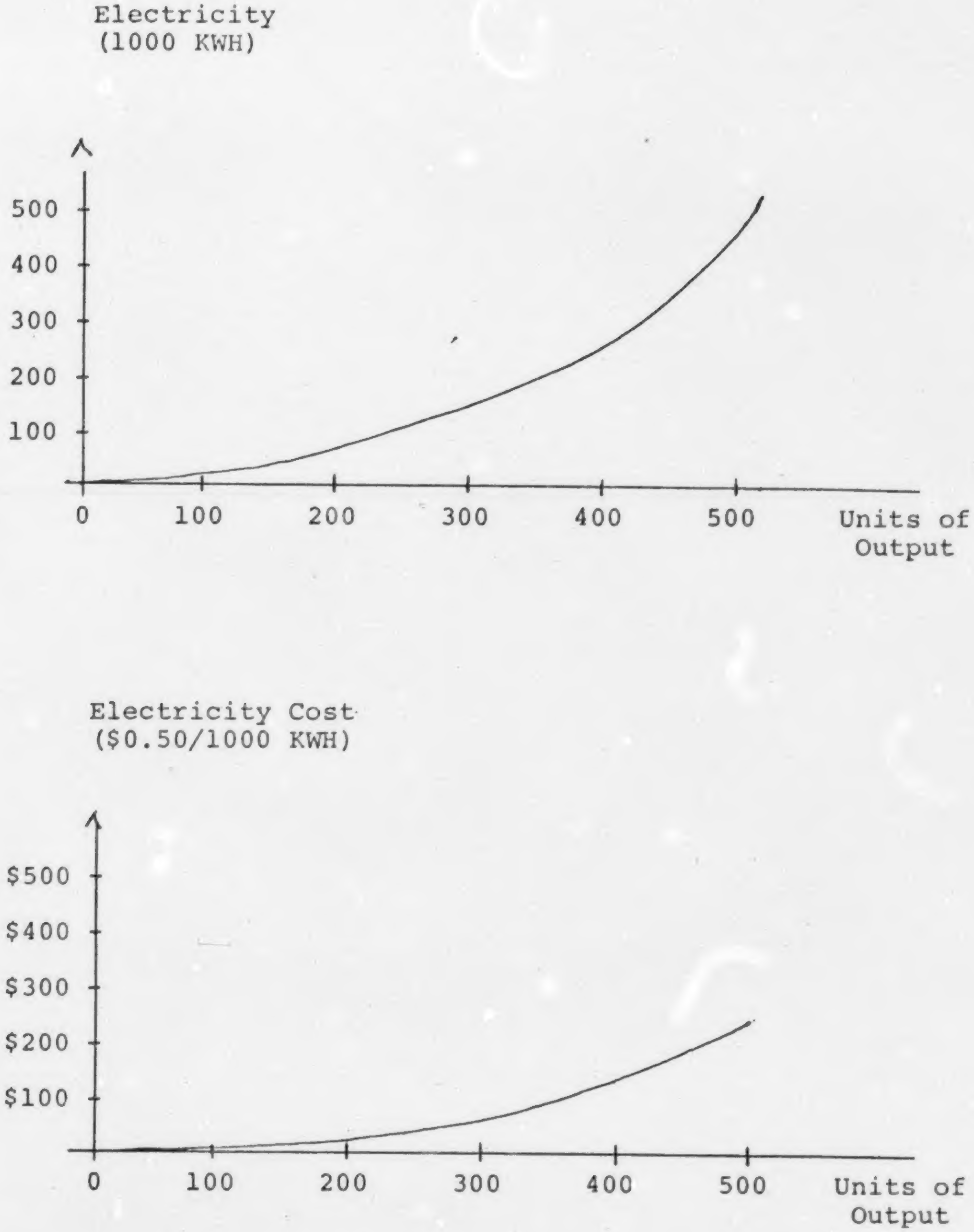
[1] The change may be either continuous or discrete. See page 4.

Chart II

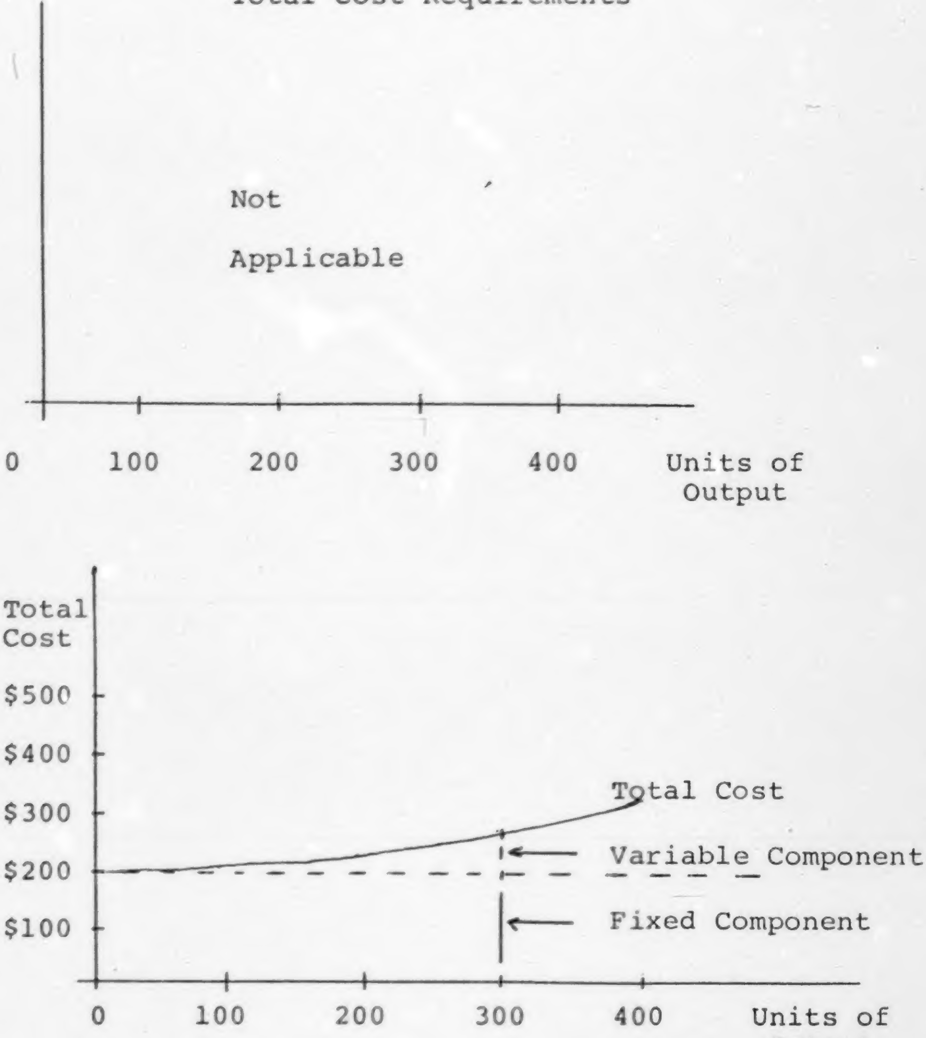
Variable Resource Requirements and Cost



The sum of fixed costs and variable costs is total cost. Chart III portrays their relationship. Since variable cost changes as output changes, economists are much concerned with how total cost changes when output changes. Costs cannot be meaningfully discussed in isolation from output.

Chart III

Total Cost Requirements

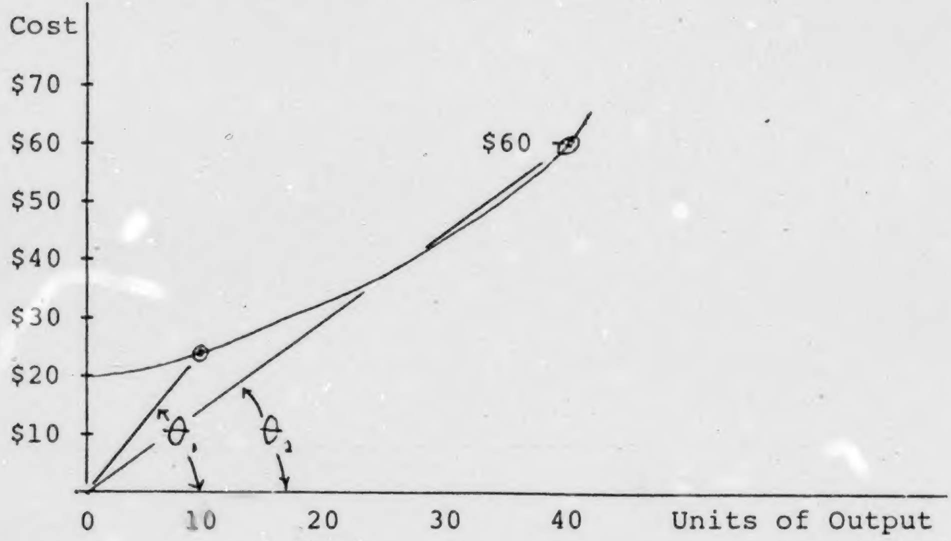


B. Average Cost

If one is interested in the cost to be allocated equally to each element of output, then one speaks of average, or unit cost. Average cost is simply total cost divided by the number of units of output.[1] The cost so divided may be fixed, variable or total. Diagrammatically average cost can be indicated by the slope of the line drawn between a point on the cost curve and the origin, or the tangent of the angle (θ) so produced. In Chart IV, average cost is indicated by two levels of output, 10 units and 40 units.

Chart IV

Average Cost
At 10 and 40 Units
of Output



1. Average cost at 6 units = $22 10 = $2.20/unit.
2. Average cost at 40 units= $60 40 = $1.50/unit.

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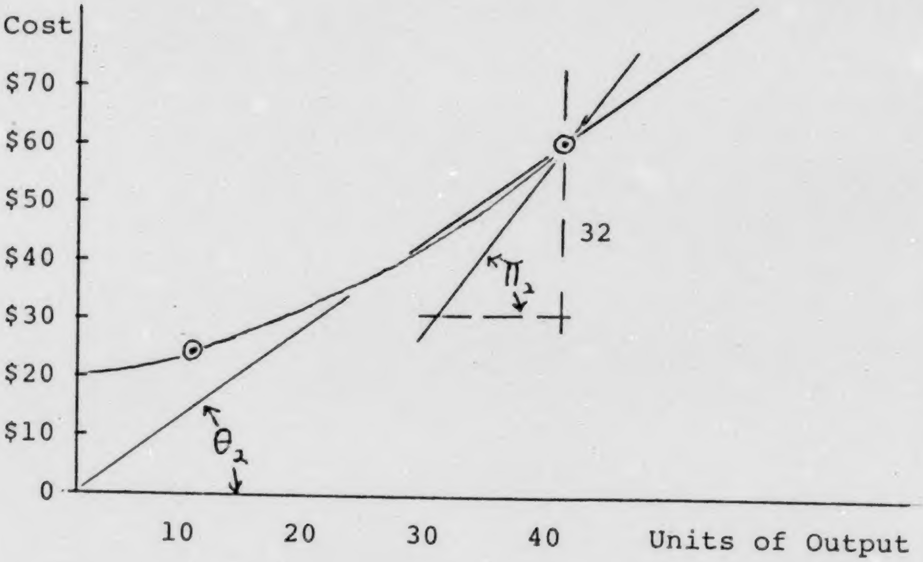
[1] This again emphasizes that a meaningful discussion of costs requires a clear understanding not only of resource requirements but of results, or output. As before average cost usually changes in response to output changes.

C. Marginal Cost

Economists are also interested in the change in cost due to changes in the quantity of output. The change in cost (Δ C) divided by the change in output (Δ X) is called marginal cost ($\Delta C / \Delta X$). If the change in output is made arbitrarily small, we speak of marginal cost at a given level of output. Its value is indicated by the slope of the tangent to the cost curve at the given output and associated cost. Chart V illustrates the concept of marginal cost and compares that with average cost.

Chart V

Marginal Cost and
Average Cost at 40
Units of Output



Average Cost = tangent $\theta_2 = \frac{60}{40}$ = \$1.50 (unit at output equal to 40.)

Marginal Cost = tangent $\pi_2 = \frac{32}{10}$ = \$3.20 (unit at output equal to 40.)

D. Incremental Cost

Incremental cost is a term related to marginal cost. Incremental cost is the change in cost associated with any change which affects the economic unit. Since one such variable is the level of service or output, marginal cost is one kind of incremental cost — the incremental cost due to a one unit change in output.

Incremental cost is frequently applied when discussing the effect on total enterprise costs of adopting a new program, either through addition to or substitution for an existing one. The incremental cost will depend not only on the total cost of the new program taken in isolation but also on the configuration of resources already available at the adopter site. Already available resources reduce the cost of installation and operation to the adopter.

VI: Cost Assignment

If the economic entity giving rise to cost produces only one product through application of only one production process, then the cost of a given level of product or service is easily determined by adding fixed cost and variable cost. However, if more than one product, or service is produced or if it is produced in more than one way, the issue is less clear. Let us illustrate. Suppose a corporation produces two products, X and Y. (X could be college bound graduates. Y could be vocationally bound graduates.) Production takes place in the same building and is managed by a common corporate staff which makes overall decisions such as the output levels of X and Y and cares for payroll, taxation, hiring, etc. Now what is the total cost of product?

A. Joint Costs

Certainly one would start with the variable costs of product X, assuming that these can be clearly traced to X, but what about fixed costs? One could clearly assign some of them as due to only one product but some irreducible minimum would be shared or joint costs. These cannot be measured as due solely to product X, or Y. One does not know how much of these shared resources are, in truth, due to X or Y. If shared costs are to be charged to X and Y, the assignment must be arbitrary. There is no other way.

Fortunately, the economist often may avoid concern with this issue. His primary interest is in determining the optimal level of output and this depends on marginal cost. Marginal cost does not depend on fixed cost.[1] Hence the problem of what to do with shared fixed costs is avoided.

B. Direct and Indirect Costs

The accountant, especially the cost accountant, has a different problem. The information assumed known by the economist[2] is often unavailable to him. Specifically, the marginal relations are unknown. This being the case, the accountant will often work from averages. His firm will often desire to set price to cover unit cost, (and unit cost is average cost.)

To determine the price of X and price of Y, the accountant must know the unit (average) cost of X and unit cost of Y.

First, we will seek to determine all costs that are unambiguously due to product X and to product Y. These are termed the direct cost of X and the direct cost of Y.[3] What remains will be indirect costs. The primary component of indirect costs will be fixed cost items but some variable costs will be included. Conversely, the primary component of direct costs are variable costs, but some fixed costs will be included.

If the allocation of a variable resource to a given production process is not measured, then the associated cost becomes an indirect cost. Moreover, the fact that the major portion of indirect costs are fixed does not imply all fixed costs are indirect.

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[1] To understand this recall that marginal cost is the change in cost divided by change in output. Now total cost is equal to variable cost plus fixed cost. Then change in total cost is change in fixed cost plus change in variable cost. But fixed cost is constant with respect to output by definition, so that the change in fixed cost is zero. Hence marginal cost is not affected by fixed cost.

[2] Economic theory works from (1) a known relation between price and output and (2) a known relation between output and resource requirements and known prices of resources. From the latter, (2), the economist therefore proceeds from a known relation between output and cost.

[3] Direct costs are those costs that can be traced unambiguously to the unit being costed. Indirect costs are those costs for which unambiguous assignment based on measurement is impossible either in practice or in principle. (Continued next page.)

C. Cost Proration

While marginal cost is not influenced by fixed cost, unit (average) cost is. If the average cost of X and/or Y is to be known (and hence a price of X and/or Y specified) then some allocation of indirect (primarily fixed) costs to each product or production process must be made. Since the allocation cannot be made directly by measurement, it must be accomplished by some more or less sensible approximation. The accountant prorates fixed costs. He cannot avoid the arbitrary problem of proration. Notice, however, that this will always introduce an arbitrary element into the cost determination.

Whenever possible it is best to avoid the detailed assignment of indirect costs through proration. The cost so derived may be misleading if one assumes that changes in the product's output will change cost by the computed cost. For remember much of indirect costs are fixed costs and they do not change in response to output changes. And whenever some costs are prorated, they should be reported separately from direct costs.

D. Capital Costs and Proration: Depreciation

We have referred to the problem of proration, or spreading, of costs in the discussion of assignment of indirect, or fixed costs. Proration occurs in another context also, and we shall now refer to that.

Resources may be classified as to the duration of their economic usefulness. Some are completely consumed when used and must be fully replaced. Energy is illustrative. Other resources provide services over many periods. Machinery and buildings are illustrative of these. In the case of resources of short persistence, their use and their payment will coincide or nearly so. However, for resources which last over many periods, the periods of use and payment may not coincide. Since the resource has been paid for in a past period, current use of the resource seems costless. The classic case is that of buildings and machinery. The production of the current period will use only part of the resource they embody. What quantity and what cost should be assigned to the current period?

Footnote 3 continued from previous page:

The analyst always has some choice as to that which he will charge costs directly. That object will be defined as a cost center. It may be a product (e.g., a custom Chevrolet) or a subcomponent of a production process (e.g., the sales department of the Chevrolet Division).

Note that this problem does not occur if the capital resource is employed by one economic entity but owned by some other. In that case the building or machinery is rented. The rent indicates the economic value of the capital resource and also coincides with the period of use.

The problem arises when owner and user are the same. There are several approaches to the assignment of cost for the period's use of this resource. All involve proration _over_ _time_.

The first is to shadow price[1] the period's use of the capital resource. In this approach one does not price the specific resource but makes an estimate based on the _rents_ paid for _similar_ facilities in similar uses under similar circumstances. Not only is this difficult to do but the observed units may have to be adjusted if the market units are distorted, as they would be under price controls, for example.

Other approaches first determine the _value_ of the capital resource and then spread that over the duration of its economic usefulness in order to arrive at a cost _per_ _period_. Both the current value (V_t) and the economic life expectancy (n) of the resource are not obvious and are themselves estimates.

One approach relies on a depreciation rate (of which 1/n, where (n) is the economic life of the capital good, is one illustration to determine the value of capital consumed in the period. This is multiplied by (1 + r), where (r) is the highest riskless price deflated rate of return to capital in the economy,[2] in order to determine the opportunity cost of the capital used. The _period_ cost (C_t) assigned to the production of the period is then

$$C_t = V_t \cdot \left(\frac{1}{n}\right) \cdot (1 + r) \qquad (1)$$

---

1. A shadow price is a constructed price in contrast to an observable price. A shadow price will be formulated whenever there is no observable price or when the observable price is distorted.
2. An interest rate is in part determined by the percent profit earned from investment (here in capital), in part determined by the rate of inflation. The value of (r) which we require has been adjusted to zero risk and zero price increase.

A second approach relies on a capital recovery factor[1] expressed as,

$$\frac{r(1+r)^n}{(1+r)^n - 1} \qquad (2)$$

The period cost assigned to the period's production is termed the cost of capital services (CCS) and is expressed as,

$$CCS^T = V_t \frac{r(1+r)^n}{(1+r)^n - 1} \qquad (3)$$

The two expressions are not identical but both have the property that the period cost increases as the rate of return, or productivity of capital, (r), increases and decreases as the economic lifetime of the capital resource increases.

This intertemporal proration is one that neither the accountant nor the economist can safely ignore if the cost charged to the production of the period is to even approximately measure the costs. The point of difference is that the accountant is likely to ignore the rate of return (r) on capital and thus to understate the economic costs of capital and to rely on a "rule-of-thumb" approximation, such as $V_t\left(\frac{1}{n}\right)$.

There is no way out of dealing with the costs of capital resources. It is important to remember that this is a proration problem, one where costs are spread over time instead of across activities, and that decisions are involved in assigning values to the economic lifetime of the resource (n), the rate of return on capital (r), the economic value of the capital resource itself (V_t); and in choosing the functional form of the proration.

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1. For discussion see Moayed-Dadkhah, Kamran and Stromsdorfer, Ernst; Cost Analysis of Manpower Programs: An Analysis of the Art; Office of Policy, Evaluation and Research, U.S. Dept. of Labor; November, 1973; page 6. See also Jack Hirshleifer, et al., Water Supply: Economics, Technology, and Policy, Chicago: The University of Chicago Press, 1960, Chapter VII to which they refer.

VII: Variety of Accounts

The variety of cost system accounts is limited only by the number of uses to which cost information can be assigned. One account system breaks costs down by the type of payment to different kinds of resources, or object. Such a system is often referred to as a line-item. Examples of the categories of such a system are wages and salaries to personnel, annual leave, holiday, rent, utilities, program supplies, office supplies, etc. Another system allocates costs on the basis of functions performed —kind of action taken or purpose for which a thing exists or for which it is used.[1] By way of illustration a common function in education is that of instruction. Still other accounts may be based on operational unit, instructional organization, job classification and activity assignment, and others. A given cost system may employ one set of accounts or any combination of two or more. In general, the greater the number of uses requiring information the more numerous the dimensions of accounts.

VIII: The Locus and Boundary of Costs (Who Pays?)

In a cost analysis it is important to determine whose costs and/or expenses are to be determined. The cost boundary may be drawn around a unit of any size from the individual, to each of the various levels of government (e.g., school district, ...federal government), and to any combination of them, and finally to the society as a whole. Frequently several of these will be involved in a cost analysis.

Model IV career education project is an example. The costs borne by the participating family will be an object of concern to that family. If those costs are excessive (in relation to benefits) then cooperation will be difficult to attain. If the program is to be adopted elsewhere, the local funding agencies will be concerned with the incremental expenses (costs and transfers) which they will incur. These expenses will net out any contributions from the federal government. Similarly the federal government will be concerned about its costs, and as an agent for society is obligated to determine the economic cost to society as well.

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[1] See Financial Accounting: Classification and Standard Terminology for Local and State School Systems 1973; Roberts, Charles T and Lichtenberger, Allan R., U.S. Office of Education; (DHEW Publication No. (OE) 73-11800; U.S. Government Printing Office; 1973; p 22 ff. For some purposes it may be wise to separate these. Counseling (kind of action taken) may be employed for several purposes.

The issues of (1) NIE program research and development costs and (2) replication costs of service delivery involve precisely this issue.

Research and development costs are those of the federal government; replication costs are those of the local sponsoring agency. The cost boundaries differ. Moreover, while NIE and potential adopters are more likely to be interested in expenses than costs, a social evaluation for efficiency purposes will focus on costs.

IX: Physical Inputs and Dollar Costs

In our early discussion, we attempted to make clear that when we are interested in costs, our first focus is upon the technological relationship that exists between results and physical quantities of resources. Costs are determined when resource prices are attached to the physical resource units. Physical resources are the link between output and cost.

In the analysis of replication costs, the adopter is more likely to be interested in resource requirements which he can price in his own market and which he can adjust for resources already available to him than in the aggregate of costs, even when broken into categories, salaries, rent, etc. or administration, career guidance, counseling, placement, etc. Estimation of incremental costs of program adoption should be based on the physical quantities of required resources.

X: Summary

This chapter has dealt with many issues related to cost. Several terms have been defined: cost and expenses; opportunity cost; fixed cost; variable cost and total costs; average cost and marginal cost; direct cost and indirect costs; acquisition costs and start-up costs; capital costs. The relationship between these have been discussed. The importance of establishing the context of cost —the analysis of boundaries and concepts— was emphasized. This leads to an important conclusion. No one cost system will be ideal. Cost and expense collection must be based on the needs of users of cost information. Where many uses are possible, it is best to collect cost, physical resource, and results information in the most detailed (disaggregated) manner. Concern for cost related data collection must be an integral part of research and development project design at an early stage.

Chapter Three

REPORTING OF PROGRAM RESEARCH AND DEVELOPMENT COSTS

This chapter addresses only the issue of reporting program research and development costs in standard categories. Treatment of this issue postpones the second issue of description and estimation of the start-up and operational costs of service delivery likely to be experienced when a program, once developed, is implemented by an adopter in a non-research and development setting. The two issues can be discussed sequentially, and the second will be discussed in the next chapter. Suffice it to say that the estimation of implementation costs of a developed program will be based in part on the cost records of program research and development.

Formulation of a cost system requires:

I. Clear understanding of the purposes to which information, once gathered, will be put.

II. Description of the production or treatment process in terms of results, inputs, and stages in production or services.

III. Specification of dimensions.

IV. Specification of basis of cost and payment reporting.

V. Design of a system for the measurement of direct resource requirements, costs, and expenses.

VI. Determination of treatment of indirect resource requirements, costs, and expenses.

I. Purpose of Data

A cost system requires that those who are to receive information from the system be clear as to its potential uses. Here, the general purpose of the cost data to be generated is to report the costs of program research and development in a manner which will permit meaningful comparison among contractors. Suggested categories include research and development, evaluation, and operations. We list these not because they are those which will be finally employed but because they indicate a desire to go beyond reporting total cost. Instead, costs are to be described in terms of the fundamental functions performed in the process of research and development. Such information will be useful for the monitoring and control of research and development costs. This purpose will be facilitated if the terms of budgeting planning correspond to those of accounting and periodic reporting.

II. Description of the Research and Development Production Process

Cost arises out of a production process. Cost information, other than total cost, will be most useful if structured in terms of that process. An understanding of the production process is the basis for the cost system to be discussed. Topics of this section include (a) definition of research and development activity, (b) activity output, (c) activity resources, and (d) processing activities.

A. Definition of Research and Development

There are no technical conventions which are widely accepted in defining the process of research and development. Several have grown up in application to the physical sciences and all, of course, in the context of business accounting. Most must be tempered in applying them to government activities in the applied social sciences.

These definitions are based on U.S. National Science Foundation definitions. They are primarily taken from the Price Waterhouse Review, Summer, 1967.[1]

1. Research and Development. Activities and their costs are assigned as research and development which include basic and applied research in the sciences (and medicine) and in engineering, and design and development of prototypes and processes. It does not include quality control, routine product testing, market research, sales promotion, sales service.

    a. Basic Research. All activities and their costs are classified as basic research which represent organized investigation for the advancement of scientific knowledge and which do not have specific commercial objectives, although they may be in fields of potential interest to the firm, or funding agency.

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[1] Halloway, Frank; "Cost Accounting For Creative and Non-Profit Activities"; Price Waterhouse Review; Vol.12, Spring 1967; pp. 24-29. Similar definitions have been referred to elsewhere. See Dorfman, Robert; Measuring the Benefits of Government Investment, Brookings Institution; Washington, D.C.; 1965; p. 14.

b. Applied Research. Activities and their costs are assigned as applied research activities which are directed to discovery of new scientific knowledge which have specific commercial objectives with respect to either products or process, (again, with respect to the intent of the firm or funding agency.)

c. Development. Development activities and their costs include those projects of technical activity concerned with non-routine problems which are encountered in translating research findings and other scientific knowledge into products or services. (Restated, development means the systematic use of scientific knowledge directed toward production of useful materials, devices, systems, or methods including design and development of prototypes and processes.)

The relationship among these three terms is shown in Chart I which follows.

In this study, we shall proceed on the basis that it is possible to distinguish applied research from development only if research is the sole R & D activity. If development is undertaken, some new knowledge can always be reported so that applied research is always involved. The distinction between newness of scientific knowledge and application of knowledge is more difficult to perceive than that between commercial objectives and non-commercial objectives. Therefore for purposes of study of CEDTF, we shall distinguish two categories (1) Basic Research and (2) Development and Applied Research.[1] The latter, we believe, defines the major portion of project work in education.

B. Activity Output

The output of research and development in education may be either a set of materials which describe the manner in which some process is to be established

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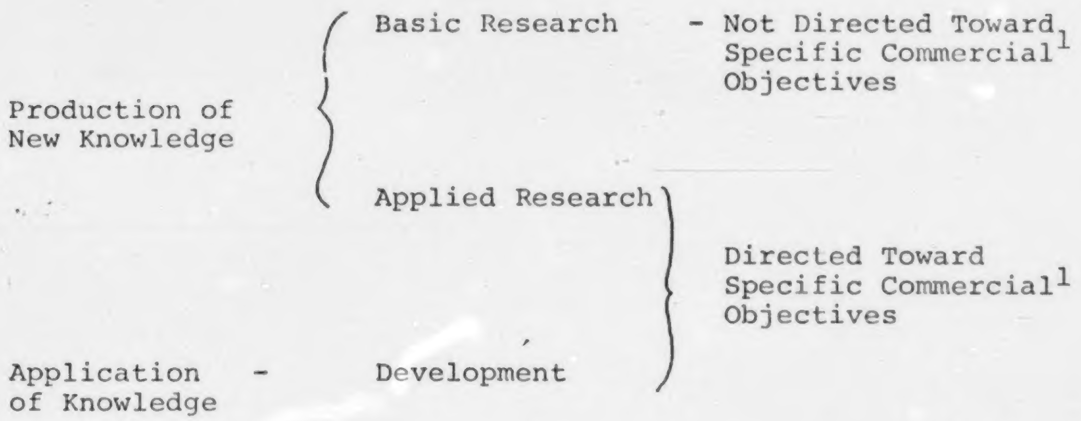
[1] Alternately, Research may be separated from development on the basis of an experimental design in the evaluation of the effects of the program upon the student population.

CHART I

Relationships Distinguishing Basic and Applied Research and Development from One Another


Production of New Knowledge
Basic Research
- Not Directed Toward Specific Commercial[1] Objectives
Applied Research
Directed Toward Specific Commercial[1] Objectives
Application of Knowledge
-
Development

and operated (a new educational production process) or a concrete product in the more tangible sense of physical items to be directly applied. In the former case, research and development has produced a new technology, itself intangible, the concrete manifestation of which is a set of handbook materials describing procedures for its installation and operation. The primary product is that result of research and development which encompases most effort and which is a prerequisite to other products.

If output is at all complex, the primary product may be broken down into subproducts. For example when the product is an entire educational system, as it is in the case of career education research and development projects, the sub-products may be various elements such as governance, management, experience site recruitment, special learning materials, or staff training procedures.

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[1] This term shall be understood as having the broad meaning of saleability, or having the capacity of satisfying a presently felt public or private need or want at an affordable price and cost.

These subproducts frequently correspond to what, at present and for budgetary purposes, are termed work units. It will therefore be useful to report costs in terms of subproducts, whenever possible. By so doing, the accounting system provides an expense record which conforms to the budgetary format.

In addition to the primary product and its subproducts, the research and development contractor may be responsible for additional related products. Cost/effectiveness studies, benefit/cost analysis, and experimental research as to the effects of the primary product are illustrative. We define these as secondary products.

Definition of subproduct and secondary products depends upon the specific research and development project.[1] To illustrate, we will choose subproducts and secondary products derived from the Experience Based Career Education (EBCE) research and development project at Northwest Regional Educational Laboratory (NWREL). Subproducts defined by that laboratory include:

EBCE Subproducts

1. Governance
2. Management
3. Instructional System
4. Basic Skills
5. Life Skills
6. Career Development
7. Guidance
8. Employer Community Utilization
9. Logistics-Student Support Service

Taken together these products are illustrative of the subproducts of EBCE research and development output. Secondary products include cost studies and experimentally designed research.

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[1] In cases where several contractors are developing the same product, the same subproduct categories should be defined in so far as possible.

C. Activity Inputs

The inputs to the research and development process are the human and nonhuman resources required to produce the primary product, subproducts and secondary products just discussed. It is important to recall that students and clients are one of these inputs as well as being an output of the production process often under development. In money terms, these resources give rise to costs. Inputs include noncost money payments, or transfers, as well. These expenses are recorded in the line item object cost record.

D. Standard Categories to Describe Research and Development

A production process consists of a number of distinct activities. Formulating a cost system requires that such activities be defined. Ideally, the elements of such a set of operations should be:

(1) Complete, or exhaustive,

(2) Mutually exclusive, and

(3) Limited in number.

In human services, no set will be fully approved by all persons concerned. We shall specify a set of activities based on our association with research and development activity in career education. We offer these as Standard Cost Categories. In doing so we fully recognize that such a list of activities and their definitions is provisional and would have to be continually modified by experience during development of a cost system.

Research and development commences with an agreement between a sponsoring or funding agency (The Fundor) and a research and development unit (The Contractor). These may or may not be separate organizationally.

Once work has been assigned to the contractor there is a period of time during which the two agencies come to final agreement as to specifications of the work. In applied research and development this will include agreement upon the exact character of the product, (e.g., provide career guidance counseling using para-professionals through telephone sessions). This the first instance of an activity which we term Fundor Negotiation and Liaison. During and following this period staff are recruited, hired, oriented and trained. This is a second activity.

The next task will be to specify the elements of structure and process and their properties necessary to the final product. Performance standards for these must be specified. Finally, the elements so specified will need to be fabricated. We categorize these activities as Product Design activity.

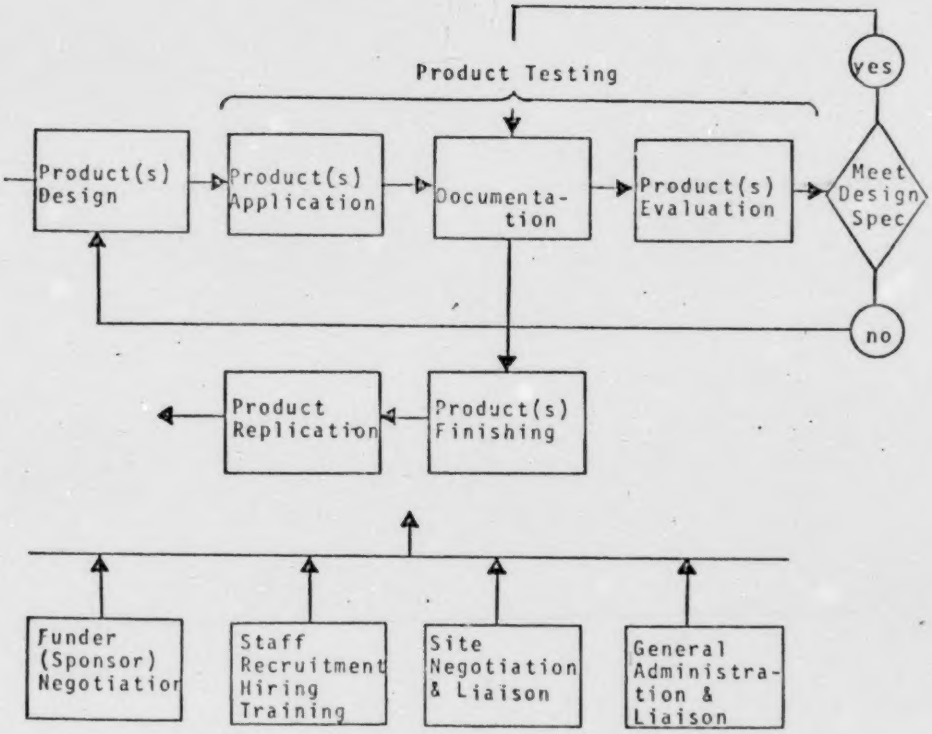
The designed elements will be tested as to efficiency. The first step in testing is to "try out" or apply that which has been designed. We define this activity to be Product Application. In order to apply the product or its elements, a site must be available. Obtaining and maintaining such a site requires another activity, Site Negotiation and Liaison. Performance of the product when applied at the site must be recorded; this we call the activity of Documentation. One use of the information so derived is to provide a basis for comparing the performance of the product with its design objectives. This activity, which also includes specification of data requirements, provision of the instruments for data recording for comparative purposes, as well as conduct of comparison and analysis, we call Product Evaluation. The activities of design, application, documentation, and evaluation form a continuous recurring process which proceeds until evaluation shows that performance satisfactorily approximates design specifications.

When performance is satisfactory, the final product is prepared. This activity will consist, as stated above, of preparation of a set of materials which describe the manner of installation and operation of the developed process or production of the proven product. This activity we call Product Finishing. Product finishing also makes use of information gained and recorded in the documentation process.

In some circumstances, the contractor performing research and development will also perform services directed toward the promotion of adoption of the developed product by potential users. In so doing, the developer may provide general information to the public, contact specific potential adopting institutions, and provide technical assistance in installation and initial operation by such institutions. This operation we call that of Product Diffusion, or replication.

CHART II

Research and Development Activities


Product Testing
yes
Product(s) Design
Product(s) Application
Documentation
Product(s) Evaluation
Meet Design Spec
no
Product Replication
Product(s) Finishing
Funder (Sponsor) Negotiation
Staff Recruitment Hiring Training
Site Negotiation & Liaison
General Administration & Liaison

Finally, there will be activities not associated with any of the operations we have just discussed. We call it General Administration Housekeeping and Clerical.

Chart II displays the relationship and activities described above.

Specific activity definitions are given below.

Activity 1. Product Design:

Product design encompasses all activity associated with the conception, planning, fabrication, and performance specification of materials, processes, techniques, institutional arrangements and structures, methodology, and approaches which are required either for the conduct of a research endeavor, supposing that to be the totality of the effort, or for the rendering of innovative and tentative educational services, supposing research is to be augmented by development. Illustrative activities from career education include but are not exhausted by the design of a particular career education approach in toto; design and fabrication of curriculum and resource materials, of student guidance procedures, of employer recruitment procedures, of telephone counseling techniques, of information systems, of employer site analysis procedures, of student recruitment techniques, of logistical arrangements (insurance, transportation, etc.).

Activity 2. Product Application:

All activity associated with the realization through use—that is implementation— of the results of design activity is defined as product application.

Illustrative career education activities include application of curriculum materials, student recruitment processes, guidance procedures, and counseling in the delivery of services to the student-client-participant; the payment for provision of logistical services once formulated and arranged; the implementation of information systems for recording and collecting information.

Activity 3. Product Evaluation:

All activities associated with devising means for the measurement and assessment of program performance relative to design standards of products as applied in Activity 2 above are considered product evaluation.

Activity 4. Product Finishing:

Product finishing includes activity associated with the fabrication of the end product of development in a form which is to be delivered to the funding agency, once acceptable performance has been validated by evaluation. Illustrative career education activities include writing and production of documents which describe the curriculum and teaching procedures in order to accomplish basic education or documents which describe the materials and methods of telephone counseling in career education.

Activity 5. Documentation:

Documentation includes all activity associated with the collection, organization, and storage of information for purposes of reporting, dissemination, and final product production.

Activity 6. Diffusion:

All activity associated with the introduction of the research and development program to general users for consideration and adoption is replication activity. The following are illustrative: preparation of materials acquainting the general public or the general educational community with the broad character, goals, and accomplishments of career education; discussions with specific groups to encourage and facilitate adoption of career education; and rendering assistance to those who have adopted or are adopting career education programs.

Activity 7. Fundor Negotiations and Liaison:

Fundor negotiation and liaison encompasses all activity associated with negotiation and liaison with the project funding agency due to: specification of operation plans, mutual agreement as to the terms of characterization and performance of research and development activity with requirements imposed by fundor-approved subcontractor requirements, and contract renewal. This activity includes assisting fundor contractors in performing their tasks.

Activity 8. Site Negotiations and Liaison:

All activity associated with securing and maintaining the permission and support of jurisdictional authorities for conduct of the research and development work in the area of their authority constitutes site negotiation and liaison. Meetings with state departments and local boards of education to elicit their support, and investigations into legal requirements for installation of career education are illustrative, as is continuing public relations.

Activity 9. Staff Recruitment and Training:

All activity associated with the recruitment, hiring and orientation of staff is staff recruitment and training activity.

Activity 10. General Administration, Housekeeping and Clerical:

All activities of a managerial, supervisory, janitorial, and/or clerical nature not specifically identifiable to any of the above is subsumed under general administration, housekeeping and clerical activity.

Costs of these ten activities will not account for all payments by the fundor to the contractor. Contractor indirect activity and expense plus fee must be included.

Again, it should be noted that the above activities are not based on an attempt to distinguish research and development activity from operations activity, where operations is usually meant to be the cost an adopter will experience if the developed product were adopted. It is our position that both research and development and operations entail many of the same activities, specifically Design, Application, Evaluation, Staff Recruitment and Training, and General Administration and Clerical. Research and development differs from operations on the basis of the absolute and relative emphasis given to each of the activities just mentioned. We are not neglecting but rather deferring the issue of cost estimation of adoptor service delivery costs until the following chapter.

One description of research and development asserts that several activities are ongoing at the same time and thereby not distinguishable from one another. We agree that this is true for the enterprise as a whole. However, our judgement focuses on the individual staff member. We believe that any single person can state the purpose of his action at any given moment in terms of the one of the ten categories listed above. It must be admitted that modification will take place should such a categorization system be instituted.

III. Specification of Dimensions

In any cost reporting system, dimensions for cost reporting must be specified. For example, three possible dimensions have been mentioned. In the previous section, we discussed resources, activities, and products and subproducts. To each of these correspond a dimension for cost accounting and reporting as follows:

(1) Resource, or Cost By Object;
(2) Activities, or Cost By Function;
(3) Cost By Product and Other Tasks.

Two dimensions, cost by activity and cost by product should be employed as a means to report costs of research and development. In the previous section, we defined ten activities as Standard Cost Categories. These are to be uniform for all research and development projects. The primary product, subproducts, and secondary products depend on the particular project and will need to be defined in relation to it. In the previous discussion, a listing of subproducts and secondary products was illustrated. (See pages 29 and 30.)

Chart II displays the combined dimensions of product and of research and development activity in the form of a possible report. The cost information of such a report can easily be related to project budget tasks and milestones.

The chart categorizes activities into those which are direct to activities and products and those which are not. Direct activities are those for which payments and resources and their cost can be traced to individual combinations of activity, subproducts and secondary products. Indirect activities are those for which resources, costs, and payments generally cannot be traced to a specific combination as described above.

In some cases, activity of one kind can be directly traced to some subproducts but not to others. We have included these as direct activities. For example, Application is included as a direct activity because in many cases it can be traced to a specific subproduct even though for some (e.g., basic skills, life skills, career development[1]) separation may not be possible. But

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1. This is our judgment at this time. Whether or not application activity relative to these three subproducts can be reported separately will be determined by experience should such a procedure be instituted.

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CHART II:
RESEARCH AND DEVELOPMENT EXPENSE REPORT

Contractor -- Period --	1	2	3	4	5	6	7	8	9	10	11	12	13
	Contract Expenses for Period												
	Direct Product/Activity Expenses for Period												
Activities Product/ Subproducts	Design	Application	Evaluation	Total (1+2+3)	Product Finishing	Documentation	Replication	Fundor Negotiation and Liaison	Site Negotiation and Liaison	Staff Recruitment and Training	General Management Housekeeping and Clerical	Total (10+11)	Total Product/Activity Direct
PRIMARY SUB PRODUCTS													
Governance													
Management													
Instructional System													
Basic Skills													
Life Skills													
Career Development													
Guidance													
Community Resource Utilization													
Logistics													
Primary Product-wide													
Total Primary Product													
SECONDARY PRODUCTS													
Cost Study													
Control Group Study													
Total Secondary Products													
Total Direct-All Products													
Indirect Assignments													
Staff Indirect													
Activity Indirect													
Product Indirect													
Total Indirect Activity													
TOTAL PROJECT COSTS													

CHART II:
RESEARCH AND DEVELOPMENT EXPENSE REPORT (Continued)

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	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Contractor -- Period --	Contract Expenses for Period							Actual-Planned Expenses to Date						
	Indirect Expenses for Period													
Activities / Product/ Subproducts	Staff Indirect	Activity Indirect	Product Indirect	Project Indirect	Total (14+15+16+17)	Contractor Indirect	Total Contract Lost for Period (13+18+19)	Total Expenses to Date	Total Non-Expenses Commitments to Date	Total Expenses + Commitments to Date (21 + 22)	Planned Expenses To Date	Discrepancy to Date (23 - 24)	Total Budgeted Expenses	Remaining Funds (26 - 23)
PRIMARY SUB PRODUCTS														
Governance														
Management														
Instructional System														
Basic Skills														
Life Skills														
Career Development														
Guidance														
Community Resource Utilization														
Logistics														
Primary Product-wide														
Total Primary Product														
SECONDARY PRODUCTS														
Cost Study														
Control Group Study														
Total Secondary Products														
Total Direct-All Products														
Indirect Assignments														
Staff Indirect														
Activity Indirect														
Product Indirect														
Total Indirect Activity														
TOTAL PROJECT COSTS														

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application is treated as a direct activity since such activity can be traced to most subproducts.

In the left hand margin, the subproducts of research and development are listed. Line 30 gives the total allocation of costs to each direct activity. Provision is also made for secondary products. These are results of activity which cannot be properly understood as component parts of the object under development. Such secondary products would include any of various cost studies of the primary R & D product. Any given row records the cost due to a particular subproduct or secondary product. The cost by activity for that product is found by reading across the row from left to right. Appropriate totals for all activities are also entered. The grand total entry (line 38) presents the totals for each column and of project expense.

Column entries show for each activity the distribution of activity cost to each subproduct and secondary product, where appropriate. Some columns make provision for cost totals of activity groupings and for indirect costs. The grand total column (column 20) displays the distribution of all costs for each subproduct, secondary product, and their total. The remaining columns provide cumulated and budget cost comparisons.

The third dimension, cost by object, need not be used for purposes of reporting research and development costs. However, concern with resource requirements and payments will enter into the discussion of replication cost estimation in the following chapter.

IV. Method of Accounting

The timing of realized income receipt and cost payment of the contractor will differ from the timing of assignment of unqualified rights to receive income and of clear obligation to make payments. Recording on the basis of actual income and expense payments is cash basis accounting. Recording on the basis of right to receive, and obligation to make, payment is accrual accounting. Accrual accounting does not require that no account be kept on a cash basis. It only requires that all substantial accounts be kept on the basis of accrual.

The timing of the allocation of resources in actual performance of services rendered and received more closely coincides with the right to receive and obligation to make payment than with actual payment. Actual payments *may be deferred and concentrated in a particular period. Therefore, records of costs based on cash flows may present a distorted picture of services performed and resources consumed. For that reason, accrual accounting is preferred to cash accounting.*[1] *Reporting* by contractors, therefore, should be on an accrual basis.

V: Direct Reporting of Resource Allocations and Expense

In so far as possible, costs and other payments should be traced directly to the combinations of product and activity illustrated in Chart II, e.g., design of career guidance. In the context of this discussion, *direct* refers to resources and cost which can be unambiguously traced to specific combinations of product and activity.

A. *Personnel Resources and Costs*

In Chart III personnel expenditures account for 58% of all costs and 70% of all contract direct costs. This is in line with most service enterprises. Consequently, accurate assignment of personnel activity is the keystone of accurate assignment of total research and development costs. This is even more evident when one realizes *that the most appropriate apportionment of indirect costs, should apportionment be made, will be based on staff time or compensation*.

Securing staff time reports in a service enterprise is difficult. Professional staff often resist time reporting. Time reporting is difficult because staff perform a variety of functions and their work efforts are not neatly circumscribed by a conventional work day.

Some enterprises have settled into routine operations or have no need to trace resources and costs to the client, patient, or student giving rise to them. In such enterprises allocation of staff time

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[1] See, for example, *Financial Accounting: Classifications and Standard Terminology for State and Local School Systems*, 1973; Roberts, Charles T. and Lichtenburger, Allen R.; DHEW No (OE)73-11800; U.S. Government Printing Office; Washington D.C.; 1973, p. 2.

CHART III

Typical Object Costs and Percent of Budgets

Account	Percent of Budget
Compensation for Personnel and Consultants	58%
Travel/Transportation of Persons	03+%
Transportation of Things	01-%
Rent and Utilities	05%
Telephone	03%
Printing and Reproduction	01%
Supplies/Materials	02%
Equipment Purchase and Rental	01%
Other Services	09%
Indirect *	16%
	99%**

* This is itself largely composed of costs due to contractor, administrative and support staff.

** Does not add to 100% due to rounding

to activities can be described by sampling the allocation of their time to activities. However, in other enterprises, one or both of the two conditions mentioned above do not apply. In these institutions, sampling is not a substitute for accurate time reporting.

This is precisely the case for developmental projects. There is need to ascribe resource allocation and cost to particular functions and processes. Secondly the program processes are not routine. Thus, it should be understood that detailed time reporting is essential to NIE research and development projects.

If time reporting is to be undertaken, the system must account for the problems mentioned above - the multiactivity nature of job performance and the variability of time and length of work hours. In addition, the reporting process must foster accuracy. Accuracy will be promoted to the degree that reporting is contemporaneous with activity and to the degree that the forms for report require minimal staff effort. To take account of these requirements, the following criteria must be met:

1. Actual hours devoted to work should be reported.
2. Reporting should take place contemporaneously with performance of duties.
3. Reporting format should minimize staff effort.

1. Staff Should Report Actual Hours Worked

The time reporting system should request staff to report the actual hours worked. Reports should include time allocated instead of, or in addition to, the regular work day irrespective of where work takes place.

As a consequence of the above, the cost of staff effort will be assigned on the basis of an effective rate of individual compensation. Individual compensation is defined to include all payments made as a direct consequence of individual employment. Compensation includes salary, money value of accrued vacation and sick leave, employer's contribution - on the behalf of the individual - to social security or any other staff benefit programs. Not included are payments which are due to all employees as a group and which do not change in response to a given individual. These are fixed costs and are properly considered as indirect costs.

Total compensation must be converted into compensation per pay (or reporting) period or compensation per working day. If compensation per day is calculated, then the value of compensation per pay period is determined by multiplying the value of compensation per day by the number of working days in the pay period. For the ith individual and the tth period, let this be CM_{it}.

The number of hours allocated to productive effort during the period will have been reported. Let this be L^*_{it}. Period compensation is divided by period hours actually worked. The result is the effective rate of individual compensation. Call this w_{it}. That is,

$$w_{it} = (CM_{it}/L^*_{it}).$$

This value will differ between individuals and among pay periods for the same individual.

Assignment of working hours to each of several combinations of product and activity is derived from staff reports. Let the time assignment by the ith individual to the jth activity and kth product be L^*_{ijkt}. Assignment of cost, $(C^L_{ijkt})^*$, of individual direct allocation to each combination is the product of hours allocated multiplied by the effective rate of individual compensation. That is,

$$(C^L_{ijkt})^* = (w_{it})(L^*_{ijkt}).$$

This method of allocation for staff services is an alternative to one based on a conventional number of hours per pay period. If a conventional number of hours is established, the computations are less numerous and therefore easier, but staff are forced to report their time in a manner that does not fit their actual allocation of time. Moreover, to the extent that allocation to the several activity-product categories does not take place randomly with respect to reportable and nonreportable hours, the cost record will give disproportionate weight to those activities which are concentrated in the normal working period of the day.

2. Staff Should Report Contemporaneously With Activity

The frequency with which staff will report time depends in part on the degree of variation in the tasks to which they allocate their time. Reporting frequency also depends on the degree of detail required in reporting, since that detail is in part a determinant of the variety of staff task assignment. Finally, frequency depends on the variation in working hours of the same individual. Where the level of detail is not great, where staff time allocations do not vary, and where working hours are constant, recording on an infrequent basis is acceptable.

As we have stated above, however, development project staff perform several tasks over the period and working hours vary. The system contains significant detail. Infrequent reporting will lead to errors in cost assignment depending on the accuracy with which staff recall time allocations and task assignments. If the errors are random, total hours will be incorrectly reported but costs will not. Only the effective wage will be affected. However, it is unlikely that errors will be random. Error for a given event will be due to memory error, and that varies with respect to proximity to point of recall, relative magnitude, routineness, and importance to the reporting staff member.

Reducing memory error is important, and therefore staff should report their time as it is allocated among several tasks. This requirement usually will not be perfectly fulfilled in actual practice. That fact only reinforces the need for forms and procedures which encourage contemporaneous reporting to the greatest possible degree. Activity reports should be submitted daily.

3. Reporting Format Should Minimize Staff Effort - A Sample Report Form

EBCE students at NWREL must keep time records. The form used also suggests itself for staff use. The form used also suggests itself for staff use. The form is described in Chart IV on the following page.

CHART IV

Staff Time Report Form

January 28, 1974	Activity	Product
7:00		
7:15		
7:30		
7:45		
8:00		
8:15		
8:30 Visit Aico Engrg	Application	Community
8:45		Resource
9:00		
9:15		
9:30		
9:45		
10:00		
10:15		
10:30 Discuss EBCE	Fundor Negotiation	
10:45 with ARIES	and Liaison	
11:00		
11:15		
11:30		
11:45		
12:00		
12:15		
12:30		
12:45		
1:00		
1:15		
1:30		
1:45		
2:00		
2:15		
2:30		
2:45		
3:00		
3:15		
3:30		
3:45		
4:00		
4:15		
4:30		
4:45		
continue on back.		

The form can be produced in monthly books with finished reports submitted daily. This particular form is suggestive only.

B. Direct Nonpersonnel Resources and Cost

Nonpersonnel resources and associated costs and payments account for 42% of all costs and 30% of all costs directly traceable to a specific research and development project. Every effort should be made to trace these costs, especially variable costs, directly to the combinations of product and activity giving rise to them. Denote these by R^*_{ijkt}.

Common procedures should be used by contractors. Some part of travel/transportation of person, telephone (primarily long distance), and other services will lend themselves to direct-reporting. The means for capturing direct cost data requires that a statement of purpose of material be recorded on purchase and work orders and that a record of long distance phone calls be kept which retains the same information.

The remaining costs are indirect. These will fall into two categories. First are those which cannot be traced directly to one of the product-activity entries in Chart II but which can be traced directly to the project. The second includes costs which can not be traced to either the entries of Chart II or to the project; these are called Project Indirect Costs.

VI. Treatment of Indirect Costs

Two categories of indirect costs have just been mentioned. One contains those indirect costs traceable neither to product-activity categories not to the project itself. We call these Project Indirect Costs.

Project Indirect Costs come from several sources. These often would be included:

A. Costs due to supervision and management above the project level,

B. Occupancy Costs - building facilities and utilities plus related expenses,

C. Costs of payroll and personnel functions,

D. Costs of technical support personnel.

Treatment of occupancy cost is most likely to vary among different contractors. Some make a direct charge to the project based on space utilized; others do not and include such charges in project indirect costs. The former practice is more informative.[1] Those occupancy costs which are directly traceable to use of facilities by the project should be assigned to it. The remaining occupancy resources and costs assigned to nonproject staff remain in the project indirect category.

An important issue with respect to indirect cost is the question of proration. Where costs must be recovered, proration is necessary. That is why project indirect costs are prorated to the project. However, where the purpose of cost information is other than cost recovery, little purpose is served by prorating costs. Doing so may actually be misleading, since direct and indirect costs tend to respond differently to changes in the project. Therefore project indirect costs should not be prorated among the several direct categories. Subject to removal of occupancy costs, a simple statement is sufficient.

The remaining category of indirect costs includes those assigned directly to the project but which cannot be traced directly to the program-activity entries of Chart II. The usual method of handling such costs is to define cost pools for the collection of indirect costs at different levels. We shall define them as activity indirect, product indirect, and staff indirect resources and costs.

Then the costs so accumulated may be prorated from the several cost centers to the appropriate cost pool. But again, why should costs be prorated at all? No purpose is served. Therefore, indirect costs should simply be reported in total.

The urge to prorate indirect cost, however, is very strong. If costs must be prorated, then the appropriate cost pool and proration formulas must be defined.

For example, one important cost pool is the individual staff member. Costs of facility, utilities, local phone, and office supplies can be traced to the individual.

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[1] However, it should be emphasized that proration, generally based on personnel time allocation to activities, is involved. Therefore, assignment of such costs should be specified in the reporting structure.

Then the cost of those items can be prorated on the basis of his time allocation to product-activity categories.

Such cost pools and apportionment formulas are always arbitrary, however. Indirect cost will be a combination of variable and fixed costs.[1] Due to this it will be difficult to draw on experiences about the effect of changes in the project on indirect costs. To the degree indirect costs are intertwined with direct costs, the ambiguity with respect to effect on cost of project changes is extended to total costs. If indirect costs are to be prorated, the reporting format should separate direct costs and prorated indirect costs before giving total cost. The method of apportionment should also be clearly stated.

In conclusion, facility cost and utilities should be separated from project indirect costs. Indirect costs should not be prorated but simply reported in two categories, indirect costs and project indirect costs. If prorated, however, direct and indirect cost assignments should be reported separately.

VII. Summary

This chapter has described a framework for a system which provides uniform reporting of research and development costs. The system stresses products and subproducts and research and development activities. It is harmonious with budgetary-planning procedures.

The standard activities are ten in umber, and we believe they encompass the work of any research and development project in the applied social sciences. These activities do not divide costs into research, development, operations and evaluation. Instead Design, Application, Evaluation, and Product Finishing are taken to be the activities that describe research, development, or operational efforts. Also no distinction is made between summative and formative evaluation. Six additional activities - Documentation, Fundor Negotiation and Liaison, Site Negotiation and Liaison, Diffusion, Staff Recruitment and Training, and General Management, Housekeeping, and Clerical - have been added. To not add these activities would be to leave substantial areas of activity uncovered. These ten standard activities define the first dimension of the cost system.

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1. See Chapter Two, page 10.

A second dimension is that composed of products and subproducts of the project. These of course will vary from project to project as they are shaped by the nature of the particular project. However, there should be similarity of product and subproduct categories among contractors charged with developing similiar programs.

The dominant cost in such projects is personnel costs. Characteristics of a time accounting system were suggested. Sampling was not used since staff activities are not routine. Staff time reporting is to be in terms of actual hours allocated to services. Cost is assigned through the mechanism of an effective rate of compensation. Staff are also to report the allocation of their time contemporaneously with their work effort. We believe that after staff have gained experience with this system and it is modified to take account of that experience, they will find it easy to work with. First, it is divorced from reporting for the purpose of pay. Second, it records the allocation of time in the terms by which it is allocated in actuality; Reporting is not impressed into a mold of the standard work day convention.

We have recommended that every effort be made to trace nonpersonnel costs directly to product-activity categories. However, substantial indirect costs remain. These fall into two categories. One contains all costs directly assigned to the project by the contractor but which cannot be so assigned to activities within it. The second contains costs not directly charged to the project. This second category often contains costs for space and the associated utilities provided by the contractor. We recommend that these be removed from this category of indirect costs and that, where possible, they be directly charged to the project.

It is possible to prorate indirect costs across product-activity categories. We believe that no purpose is served by so doing when reporting development costs and that indirect costs should simply be reported. Should proration take place, indirect costs should be reported separately from direct costs.

In closing we look ahead. The next chapter considers the issue of service delivery cost in a nondevelopment setting. There it will be the case that resource requirements in physical dimensions will play a greater role. In that endeavor, the kinds of proration herein made will often have a less productive role.

Chapter Four

ESTIMATION OF ADOPTER COSTS OF SERVICE DELIVERY

The discussion of cost recording and reporting for purposes of describing research and development programs included neither an activity termed research and/or development nor one termed operations. This was no oversight. It was intentional, a consequence of our belief that many activities present during research and development are also present operationally, although at different absolute and relative levels. In this conception, operations are embedded in the structure of research and development in such a manner that operations cannot be considered as distinct and separate from research and development.

Yet development results in a more or less proven product or process. The expectation is that general adopters will adopt and use it in applied situations. Such an institution we define as an adopter.

An adopter will require answers to questions concerning the costs of service delivery. These service delivery costs depend on many factors. We list five of these in Chart A.

Cost estimates differ with respect to the number of such factors which may vary in the estimate. We shall discuss two kinds of estimation.

CHART A

Cost Factors

A. Service configuration - The particular services and their level of activity in the program as adapted by the adopter.

B. Wage and price level in the adopter market.

C. Presence of subsidies to the adopter.

D. Sunk Resources - Resources presently underutilized by the adopter and therefore available at no additional cash expense to the adopter.

E. Level of activity - Number of students or clients.

First, at an exploratory stage, the potential adopter will desire a rough estimate of cost in order to decide whether or not to continue exploration. Such a figure should be provided by the agency distributing the developed product. We shall call this estimate the exploratory cost estimate.

An estimate will be made for each of the acquisition costs and of the operational costs. Acquisition costs are those which will be incurred in developing the capacity to provide educational services. Acquisition of required materials, staff, and skills are included. Operational costs are those that are incurred in the process of providing services. Acquisition costs are a one time fixed cost, and are independent of time period. For example, acquisition costs are stated as $200.00. Operational costs are repetitive, a combination of fixed, semi-fixed, and variable costs. They are not independent of time period and are expressed as a rate of flow. Operational costs, for example, are stated as $200,000 per year or $1,110 per day.

The exploratory estimate need not be detailed. Little or no effort should be required to produce it on the part of the adopter. A range of expected cost expressed in terms of an upper and lower limit will suffice. The values of these estimates will depend on the five factors listed in Chart I. This cost estimate may take the form of the following statement.

"We estimate that your cost will be between $X and $Y per month (or per year) to operate the program for Z students, and between $M and $N to acquire the capacity to serve them."

The provision of estimate in total terms rather than cost per student is deliberate. There is no reason to believe that average costs would be constant at changed levels of output.[1]

If the adopter decides to continue beyond initial exploration to serious consideration, then cost estimates must be refined. An estimate of program cost in the adopter's specific setting is required. Cost factors in addition to level of activity must be taken into account. Specifically, local wages and prices, and resources available without cost to the adopter must be considered. We shall call this estimate the incremental[2] cost of adoption.

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[1] See Chart IV, Chapter Two.
[2] The reader is referred to Chapter Two, page 13.

The estimates to be made involve three levels of complexity. These are related to the level and service configuration of program activity, two of the five cost factors listed in Chart I.

Level A

What are the resource requirements and costs required to operate the program in the same component service configuration and at the same level of operations experienced at the measurement (usually the development or field test) site? This level provides cost estimates for only one value of service activity (e.g., number of students) and only one configuration of service. It is less an estimate and more a description.

Level B

What are the resources and associated costs required to operate the program in the same component service configuration experienced at the measurement site but at several alternative operating levels? This level provides estimates for different values of service activity, all with the same configuration of service.

Level C

What are the resource requirements and costs required to operate the program in alternative component service configurations for each of several alternative operating levels? This level provides estimates for different service configurations for each given value of service activity.

There are three major difficulties which arise when these issues are investigated on the unadjusted basis of cost records derived for accounting of research and development activity and cost. The difficulties are:

1. Resource prices for staff employed in the same job positions are likely to be different — probably higher -- in a research and development than an operational setting. This is due to the higher qualifications and reduced job security associated with research and development employment. This can be remedied by estimating physical resource requirements and then applying resource prices appropriate to an adopter setting.

2. Operations differs from research and development on the basis of the relative weight of activity and cost in each of several categories rather than the qualitive nature of the categories themselves. That is, design and evaluation in addition to application are activities found at operational as well as research and development sites. What differentiates the two is that the emphasis on design and evaluation relative to application is diminished in an operational compared to a research and development setting. This problem can be met by extracting purely developmental activities insofar as possible and by measuring at periods best approximating operational conditions.

3. The accounting systems of adopters are likely to differ from those of research and development agencies. This is especially true if the research and development contractor is a profit making entity. The particular case which is most prevalent is that of costing the use of capital resources --buildings and equipment. Contractors frequently consider this item as a cost while school districts tend to exclude presently existing facilities. Reconciling those differences can be accomplished by again specifying physical, nonmonetary requirements first and then translating those requirements into dollar values.

In approaching the estimation of program delivery costs, the central feature is to begin not with costs but with specification of quantity resource requirements.[1] Cost, the expression of resources in dollar terms, follows. At the point of costing, prices and wages are applied based either on averages of adopter prices and wages in the case of the exploratory estimate or on individual adopter market prices and wages in the case of the incremental estimate. Also, those resources not requiring additional cash expenditures on the part of the specific adopter are excluded in formulating the incremental estimate.

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[1] This is due to a suggestion by Haggert in which physical units of resources and completeness of resource listings are emphasized. See Haggert, Sue A.; Program Cost Analysis in Educational Planning; Rand Corporation, Santa Monica, California; December 1971.

To formulate estimates, therefore, at least the following information must be provided:

1. A complete list of resource requirements,

2. A statement of tasks to be accomplished and services to be rendered,

3. A statement of adopter average prices, wages, and benefits for those resources required by the program in an operational setting.

4. A statement of representative hours which the adopter can expect to allocate to program tasks and services in operational setting.

    a. Alternately, the average adopter market effective wage for various types of operational staff.

5. In the setting of this study, the resource allocations to the categories of activity described in the previous chapter.

6. A statement of those resource quantities which are available at zero additional cost to the local educational agency (e.g., unused space or equipment).

7. A statement of various task accomplishment or productivity measures, e.g., number of students recruited, number of participants contacted by telephone, number of community resource slots recruited.

The previous list implies that resource allocations are maintained in three dimensions: resources, research and development standard categories, and program components, or tasks and services. The list of task and service requirements is a refinement of the list of research and development subproducts discussed in Chapter Three. The major refinement is to delineate the instructional process, community resources, and governance subproducts more fully. The requirements for additional detail increase as one moves from estimating Level A to estimating Level C. Therefore, the data required for estimates of service delivery can be based on the reporting system for development costs when modified by the refinements stated above.

If data does not exist to satisfy each of the seven requirements stated above, then estimation is based on assumptions. Such assumptions should be clearly stated.

For example, data may not be available to estimate the effective wage of operational staff. In that case, one may assume that the average number of hours per time period to be allocated by adopter staff to the program is equal to (or is X times) the average number of hours actually allocated per week by development staff. Then the effective adopter wage will be the development staff effective wage multiplied by the ratio of operational to developmental salaries, all multiplied by 1/X. The assumed relation of the actual work week of developmental staff to that of operational staff, here the value of X, should be made explicit.

I. Estimates of Adopter Service Delivery Costs (Level A)

It will be recalled that the problem is to give a reasonable estimate of the acquisition and operational costs of the program at the level of activity and the configuration of service identical to measurement site. Both exploratory and incremental estimates are required for each of acquisition and operational costs.

A. The Exploratory Estimate

1. Operational Cost

The exploratory estimate of operational cost is based on the data generated from reporting the research and development costs. Specifically, the following:

a. The time allocation of personnel to research and development activities,

b. The adopter average wages for required personnel,

c. The adopter average hours actually worked per time period for required personnel,

d. The allocation of other resources to each of the research and development activities,

e. Adopter average price for such nonpersonnel resources.

The resource allocation information of "a" and "d" requirements are collected on the basis of the reporting system described in Chapter Three. The values which satisfy the remaining data requirements would have to be developed or be assumed.

CHART I

BEST COPY AVAILABLE

CHART I EXPLORATORY ESTIMATE OF OPERATIONAL COSTS

		1	2	3	4	5	6	7	8	9	10	11	12
	ITEM	DESIGN		APPLICATION		EVALUATION		STAFF RECRUITMENT & TRNG		GENERAL MANAGEMENT, HSKPG. & CLERICAL		TOTAL	
		Quantity	Dollars	Quantity	Dollars	Quantity	Dollars	Quantity	Dollars	Quantity	Dollars	Quantity	Dollars
1	PERSONNEL												
2	Staff												
3	Program Manager												
4	Secretarial												
5	Clerk Typist												
6	Sr. Learning Coordinator												
7	Learning Coordinator												
8	Senior Employer Specialist												
9	Employer Specialist												
10	Counselor												
11	Resource Center Manager												
12	Other Staff (Specify)												
13													
14													
15	Total Staff												
16													
17	Non Staff												
18	Consultants												
19	LEA												
20	Other												
21													
22													
23	Total Non Staff												
24	TOTAL PERSONNEL												
25	TOTAL NON PERSONNEL												
26	(LESS)FACILITIES & OFFICE EQUIP.												
27													
28													
29	REMAINDER												
30	TOTAL ADJUSTED RESOURCES												
31													
32	ASSIGNMENT FOR ESTIMATE		$C^A_{..1}$		$C^A_{..2}$		$C^A_{..3}$						
33													
34	TOTAL APPLICATION (4) = E_1				$C^c_{..2}$								E_1
35	TOTAL (2) + (4) + (6) = E_u		$C^e_{..1}$		$C^c_{..2}$		$C^e_{..3}$						E_u
36													
37	FACILITIES & OFFICE EQUIP. ADJ.												
38	TOTAL APPLICATION *(34 + 37)												
39	TOTAL: (2)+(4)+(6) *= (34 + 38)												
40													

On that basis it will be possible to construct a chart such as Chart I. The data is entered either on the basis of directly traced or prorated assignments. One step is the exclusion of resource allocations to activities which are clearly not operational. We assume the activities of Product Finishing, Fundor Negotiation and Liaison, Site Negotiation and Liaison, Documentation, and Diffusion to be those not found in an operational setting. These are excluded from Chart I. The activities of Design, Application, Evaluation, Staff Recruitment and Training, and General Management, Housekeeping, and Clerical remain.

The next step is to enter all personnel, and some nonpersonnel resource allocations in physical units and the remaining nonpersonnel in dollar units into Chart I. This is based on the assumption that wages and salaries will vary from region to region and from research and development to operational sites but that nonpersonnel prices are more nearly constant as between application in research and development and in operational settings and across areas of the country.

An exception to recording personnel resource allocations in terms of physical units is that of consultants and other nonprogram personnel. These are valued in dollar terms for reasons similar to nonpersonnel resources.

The next step is to assign dollar values to staff personnel resources. To do so, we use national average personnel compensation values for operational settings. These may be adjusted for differences in actual hours of work. If we let

1. $\bar{w}_i$ = Average national effective rate of compensation, where

2. $\bar{w}_i = MC_i/\bar{L}_i$, the quotient of average monetary value of compensation divided by average actual time allocation, then

3. $\bar{C}_{i.h} = (L_{i.k})\,\bar{w}_i$.

This is the value which is entered as the adopter exploratory estimate of personnel cost.

The value for nonpersonnel resources is entered in line 26. This may be calculated from values based on national average prices or developer prices, if the assumption is made that nonpersonnel goods and service prices do not vary greatly as between developers and adopters.

To this point, dollar values have been entered for all resources traced to the five activities noted in the column headings of the chart. The next task is to prorate the costs of Staff Recruitment and Training and General Management, Housekeeping, and Clerical to those of Design, Application, and Evaluation. This is accomplished as follows. First determine the total of all staff time directly traced to each research and development activity excluding staff recruitment and general management. Denote this as,

4. $$L^{*}_{..s} = \underset{k=1}{8} \quad L^{*}_{..k} \ .$$

Then form these ratios,

5. $$L^{*}_{..1}/L^{*}_{..s} \ , \quad L^{*}_{..2}/L^{*}_{..s} \ , \quad \text{and } L^{*}_{..3}/L^{*}_{..s}$$

the ratios of time allocation of Design, Application, and Evaluation to total time allocation.

The ratios are applied to the costs of the two activities to be prorated, $(C_{..9} + C_{..10})$ to form the products.

6. $$\frac{L^{*}_{..1}}{L^{*}_{..s}} (C_{..9} + C_{..10}) = C^{A}_{..1}$$

7. $$\frac{L^{*}_{..2}}{L^{*}_{..s}} (C_{..9} + C_{..10}) = C^{A}_{..2}$$

8. $$\frac{L^{*}_{..3}}{L^{*}_{..s}} (C_{..9} + C_{..10}) = C^{A}_{..3}$$

These are entered in the row titled Assignment for Estimate and added respectively to the totals for each activity or $C_{..1}$, $C_{..2}$, $C_{..3}$. The sum is indicated as $C^e_{..1}$, $C^e_{..2}$, and $C^e_{..3}$.

The lower exploratory estimate of operational costs is

$$9. \quad C^e_L = C^e_{..2} = C_{..2} + C^A_{..2}$$

The upper exploratory estimate of operational costs is

$$10. \quad C^e_u = C^e_{..1} + C^e_{..2} + C^e_{..3} ,$$

$$= \overset{3}{\underset{k=1}{}} (C_{..k} + C_{..k}{}^A) ,$$

It will be recalled that costs of some facilities and equipment have been excluded from the above estimate. They may be included by prorating the costs of these resources allocated to Staff Recruitment and Training and General Management, Housekeeping, and Clerical to those of Design, Application, and Evaluation. The value determined for Application is then added to the lower estimate. The value determined for the sum of Design, Application, and Evaluation is added to the upper estimate.

We must specifically state that the resources allocated to any secondary products (e.g., special research studies) are excluded from those used for estimation. In addition the allocation of resources and costs due to personnel not in "operational" assignments are also to be excluded from the upper estimate.

Estimation based on this process can be made at any time. However, we feel that the estimates will best approximate the true value if estimates are made after the program is operating at its projected level of operation. We are not concerned at this point with the deployment and cost of resource allocation to tasks and services within the program. Therefore it will not be necessary to construct the estimate for a period sufficiently long to include a full program cycle.

The estimate may be expressed as a dollar rate per year or per month. The estimate may be based on as little as one month's cost behavior, if necessary.

A longer period is preferable, however, in order to avoid an estimate biased by the presence of special factors operating within a given month.

Furthermore, the range between the upper and lower estimate can be expected to diminish the more closely the program approximates an operational character at the points of measurement. Therefore, cost estimates based on experience toward conclusion of the development program or on field test application can be anticipated to produce the best estimates.

2. Acquisition Cost

The ease with which operational costs are estimated is a consequence of their tendency to repeat period after period. This means there are many potential points of measurement. Moreover, if we assume that the adopter will be led to exactly duplicate the program, we can neglect the specific tasks which comprise the program and focus on total costs.

In the estimation of acquisition costs, one difficulty is that acquisition tasks do not repeat themselves. Therefore, if acquisition costs are not recorded when in process, they cannot be measured as acquisition processes later during development.

Should data be retained, estimates derived from them are likely to be in error on the high side. In the first place, these costs will include considerable trial and error as developers seek to find a procedure which accomplishes the ends desired; procedures will be modified. Secondly, even for the preferred procedure, experience in the acquisition period will not have developed learning (and hence proficiency) of staff to the point that will occur later.

Also, in the research and development environment, acquisition of resources to apply designed techniques and materials is frequently based on a level of activity less than that ultimately desired and on which the estimate is to be based. Moreover, acquisition tasks based on increasing the level of application activity are likely to be pursued contemporaneously with application services rendered to students. Thus, acquisition of capacity is difficult to separate from the application of that capacity. There will be no clear period when acquisition activity is separate from other activity during development.

Consequently, to formulate an estimate of acquisition costs, we must construct a list of acquisition tasks based on judgment as to requirements for the specified level of operational activity which is the basis of the exploratory estimate of operational cost. Then estimates of the quantities of resources and costs required for those tasks can be assigned.

The accuracy of estimation will be increased to the degree that modifications, previously mentioned, which increase slightly the detail of the reporting system, are made. These modifications establish subcategories which take account of the separation of acquisition from operational effort. For example, in our illustration based on EBCE, it would be productive to modify Governance and Community Resource utilization. Governance could be divided into a category for Recruitment Selection and Formation, and another for Governance Conduct. Similarly, Community Resource Utilization either should be defined to include only site recruitment and resource person identification and analysis or should be subdivided so that such activity is separated from other activity pertaining to community resource utilization.

In Chart II, illustrative acquisition tasks based on EBCE are listed horizontally across the top of page as column headings. Resources are listed vertically as row headings. The resource listing is similar to Chart I. It must be remembered that a third dimension includes research and development activities not excluded due to being peculiar only to research and development effort. Due to this, there must be a separate chart for upper and lower estimates. Chart II is for lower estimates. That is, the quantities entered for program staff are the measured values for Application activity plus an assignment from the proration of Staff Hiring and Training and from General Management, Housekeeping, and Clerical. The same applies to dollar value entries in lines 17 through 24. A chart for calculation of the upper estimate would include measured values for Design and Evaluation of operational staff as well as Application.

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CHART II

CHART II LOWER EXPLORATORY ESTIMATE OF ACQUISITION COSTS

TASK / RESOURCE	ACQUIRE HUMAN RESOURCES						ACQUIRE PROGRAM MATERIALS						Acquire Program Equipment		Acquire Office Equip/Supp.		Acquire Facilities & Utilities		Acquire Logistic Capacity		TOTAL	
	Students		Community Resources		Governance		Learning Package		Cross Reference		Texts											
1	Q	$	Q	$	Q	$	Q	$	Q	$	Q	$	Q	$	Q	$	Q	$	Q	$	Q	$
2																						
3 PERSONNEL																						
4 Staff																						
5 Program Manager																						
6 Secretarial																						
7 Clerk Typist																						
8 Sr. Learning Coordinator																						
9 Learning Coordinator																						
10 Sr. Employer Specialist																						
11 Employer Specialist																						
12 Counselor																						
13 Resource Center Manager																						
Other Staff (Specify)																						
15																						
16 Total Staff																						
17																						
18 Non Staff																						
19 Consultants																						
20 L E A																						
21 Other																						
22																						
23 Total Non Staff																						
24 TOTAL PERSONNEL																						
25																						
26 TOTAL NON PERSONNEL																						
27 (LESS)FACILITIES & OFFICE SPACE																						
28																						
29 REMAINDER																						
30 TOTAL ADJUSTED RESOURCES (24 - 25)																						
31																						
32 ASSIGNMENT FOR ESTIMATE																						
33																						
34 TOTAL APPLICATION (3) • E_L																						
35																						
36																						
37 FACILITIES & OFFICE EQUIP ADJ.																						
38 TOTAL APPLICATION * (3) - E_L *																						
39																						

Completion of such a chart can be made on the basis of measurements taken in the acquisition phase of research and development, application, or field testing. The latter offers the best opportunity to measure acquisition tasks during an acquisition period as such.

However, due to the problems stated above, many acquisition task resource requirements must be constructed on the basis of judgment. To do this requires:

1. A statement of the number of students to be served. (This is based on the operational estimate),
2. A statement of the program resources and materials which must be available to the student if he is to be rendered services (e.g., number of learning sites, learning packages),
3. A measure of the total allocation of staff resources to replenish such materials over the course of some time period.
4. A measure of the number of units of output of such effort (e.g., number of community resources recruited, number of learning packages formulated)

Consider the category, acquisition of human resources. It will be known that a specified number of students are to be recruited. Based on operating experience and given the number of students (in the program) the number of community resource slots can be predicted. Also the composition and number of individuals in the governance unit can be specified. Let

11. Q_s = The number of students enrolled at any time.

12. $\overline{N}_{.j.}$ = The number of units of the j^{th} intermediate product[1] required per student.

---

[1] An intermediate product is a product used in the production of another product. Here a student and a resource slot are intermediate products.

Student recruitment and community resource recruitment and analysis are activities that take place both during acquisition and during operations. During operations, activity allocated to such tasks should be reported. If it is, then the quantities of time by each of several personnel resources will be known. Let

13. $L^*_{ij.}$ = The resource allocation to the j^{th} task by the i^{th} personnel staff resource over the period.

14. C^*_{ij} = The cost allocation to the j^{th} task by the i^{th} nonpersonnel resource over the period.

Records of the productivity of resource allocations should be maintained. On the basis of such data, the total number of students recruited and community resources developed will be known. Let this be

15. $X_{.j.}$ = The number of units of the j^{th} intermediate product due to resources allocated to the j^{th} task over the time period

Then the number of resources which must be acquired for Q_s students can be estimated as

16. $$R^a_{ij.} = \frac{L^*_{ij.}}{X_{.j.}} (\bar{N}_{.j.})(Q_s), \text{ or}$$

the quantity of the i^{th} resource which must be allocated to acquire the j^{th} intermediate product (student recruits, community resource slots). The cost is given as

17. $C^a_{ij.} = (R^a_{ij.})(\bar{w}_i)$ for staff personnel and

18. $C^a_{ij.} = \frac{(C^*_{ij.}}{X_{.j.}} (\bar{N}_{.j.})(Q_s)$ for other resources.

The value, $\bar{w}_i$ is understood as before. One can sum over all resources to determine total estimated cost remembering to apply the procedure outlined in estimating operational costs. There will be an upper and lower estimate. The two will differ, it will be remembered, by Design and Evaluation costs due to operational personnel.

Not all acquisition task costs can be estimated on the basis of operational experience. For example, facility acquisition is not recurring. If no records exist to note the actual allocation to this task, then an estimate based on memory and judgment must be substituted for measured quantities. Such estimates should be structured around the processes described above. That is, estimates should be in terms of time allocations of staff. An upper and lower estimate should be made. For personnel resources, effective wage rates built on adopter averages should be used to calculate personnel costs.

One warning. We have considered the exploratory estimates to be very rough. The estimation process for acquisition costs just described contains the proration of some fixed resources which will, in fact, not be divisible. The estimate may provide for the identification of such resources and for adjustments based on judgment. This will complicate the process. We have proceeded with the simpler process since it seems adequate for the rough estimate it is and provides an estimated range of cost in any case.

B. Incremental Estimate

The incremental estimate differs from the exploratory estimate in two ways:

1. Local effective wages are substituted by the adopter for national averages of wages paid by all adopters.

2. The adopter inspects the resource requirements in order to determine which of them are available at no additional cost to the adopting unit.

1. Operational Costs

In order to estimate operational costs, the quantities of personnel and nonpersonnel resources in Chart I, after proration of Staff Recruitment and Training and General Managerial, Housekeeping and Clerical, must be provided to the adopter on an item by item basis. The proration formula continues as $L^{*}_{..i}/L^{*}_{..s}$ but is applied to each resource individually.

Chart III provides an illustrative format for the lower estimate of operational costs. The first column lists the individual types of resources. In the first numbered Column (1), the physical units for each resource are entered. These will be based on Columns (1), (3), and (5) of Chart I, plus the adjustment due to the prorated share of Staff Recruitment and of General Management. Since this is a lower estimate, the resource assignments traced or prorated to Application would be entered. For the upper estimate the sum of each resource assigned to Design, Application, and Evaluation would be entered. Column (2) converts these values (e.g., hours) into unit quantities (e.g., number of employees). Total hours are divided by the average hours worked per position unit and rounding. Column (3) provides an opportunity to adjust the estimated quantity for indivisibilities. That is, included in the proration process are fixed resources which will be the same regardless of the level of activity. For example, proration may result in a value of 1/2 telephone per staff person. Standard practice may assign one per person. Column (3), Adjusted Gross Positions, provides for that kind of adjustment. If no adjustment is made the entry from Column (2) is repeated.

Some of the gross resource requirements may be available at no incremental cost to the adopter. The number of units for these resources is entered in Column (5) in the same units as in Column (4).

In Column (5), the net incremental resource requirements are entered. The value is the difference between gross and net requirements.

The incremental cost for each resource is obtained by entering the effective wage or price experienced in the adopter market in Column (7). The product of the physical value of Column (5) and the price of Column (6) is entered in Column (7).

For some resources (for example, expendable materials and supplies) a simple aggregation and listing of cost will be entered on a prorated basis directly in Column (7).

In any case, the adopter again modifies the quantity required to account for fractions which are not sensible and applies price values which fit his case in order to arrive at the incremental cost of operating the program.

CHART III

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CHART III LOWER INCREMENTAL ESTIMATE OF OPERATIONAL COSTS

		1 Estimated Quantity	2 Gross Position Estimated	3 Adjusted	4 Zero Cost Position	5 Net Position Reqm't (4) - (5)	6 Price per Position	7 Cost (6) x (7)
1	PERSONNEL							
2	Staff							
3	Project Manager							
4	Senior Secretary							
5	Clerk Typist							
6	Sr. Learning Coordinator							
7	Learning Coordinator							
8	Sr. Employment Specialist							
9	Employment Specialist							
10	Other Staff (Specify)							
11								
12								
13	Non Staff							
14	Consultants							
15	L E A (Specify)							
16								
17								
18	Other (Specify)							
19								
20								
21	NON PERSONNEL-PROGRAM (Specify)							
22								
23								
24								
25	Non Program (Specify)							
26								
27								
28								
29	Occupancy							
30	Facility (Specify)							
31								
32								
33								
34	Utilities							
35	Facility Insurance							
36	Non-Long Distance Telephone							
37								
38								
39								

When considering facilities and office equipment, the adopter entry will depend on the means chosen to acquire those resources. For example, if the resource is to be rented, then the cost will appear as an operating cost. If the resource is to be purchased, then it will not be considered as an operating cost but as an acquisition cost. If previously constructed, a zero cost entry will be made, but if specially provided, a positive cost will be recorded. In such a case some capital consumption factor should be applied.

The implication of this is that whether a given resource is classified as an acquisition or operational requirement will depend on the manner in which it is to be financed. This problem cannot be avoided. It can only be solved by allowing the adopter to cost out the program based not only on his resource availabilities and his prices, but also on his method of finance and procurement.

2. Acquisition Costs

A chart similar to that of Chart III is prepared to estimate acquisition costs. The basis may be any of the sources referred to when discussing exploratory estimates of acquisition costs. Data may be taken from acquisition during research and development, from observation of recurring tasks during operations which are also required in acquisition, from judgment and memory where no records exist, and finally from records of field test acquisition costs. The latter will provide the best opportunity. The same list of resources appears in the left column. The quantity and cost entries are those necessary to accomplish the tasks denoted in Chart II. Again the adopter computes cost by applying price factors which prevail in his market after excluding resources available at no incremental cost. The attribution of the cost of capital resources again depends on the means of their provision, and of course there must be consistency in this regard with respect to acquisition and operational estimates. Again, there will be a lower and upper estimate derived due to upper and lower estimates of personnel requirements.

C. Summary

This section has discussed the estimation of cost when the developed program is installed and operated "as is" by the adopter. The quantity of students served and the kinds and quantities of services offered to them are assumed to be identical to the development setting. For this reason, we did not concern ourselves with fixed and variable costs, resource indivisibilities, or the allocation of cost to each of several acquisition tasks or operational services.

One set of estimates provides upper and lower exploratory estimates. Averages of adopter effective rates of monetary compensation are applied to quantities of resources recorded under the reporting system of Chapter Three. Lower estimates utilize resource allocations to Application activity plus a prorated share of Staff Recruitment and Training and of General Management, Household, and Clerical activity. The upper estimate adds operational resources allocated to Design and Evaluation activity; to these are added the prorated share of the Staff Recruitment and General Management activity.

The second, more detailed, estimate is that of adopter incremental cost. Again upper and lower estimates are provided. The estimated adopter incremental cost requires that a list of required resources be specified in detail. Resources are costed using prices and wages prevailing in the adopter market. A zero cost is entered for resources which can be made available by the adopter at no incremental cost to himself.

In order to facilitate estimation of acquisition costs, the subproduct categories specified for the reporting system in Chapter Three must be modified by a slight increase in detail.

II. Estimates Under Conditions of Variable Levels of Activity

Estimates of the resource requirements and cost when changes in the program activity level or structure are permitted is a much more tenuous task than that just described. The estimates will have much larger error.

In order to provide accurate estimates of cost under changing levels of activity the production function of the program must be known in detail. That is, one needs to know how the quantities of each kind of resource respond to changes in the required level of activity (number of graduates). If the program were observed in many different settings and at many different levels of activity, a statistical history would be available. Based on that experience, a relation between activity level and resource requirements could be formulated by means of regression analysis.

The defining characteristic of developmental programs, however, is the absence of such a history. Regardless of the level of detail of data collected to describe the program it will still be the case that the variety of recorded experiences will be limited in the extreme. Observations are limited to development and any field test. This being the case there will be no basis upon which rigorous predictions of cost can be formulated. It cannot be emphasized enough that any estimates on such a restricted basis must be used with caution. This being the case, how is one to proceed?

One approach to the problem would be to determine the ratio of desired activity to observed activity:

1. Let X^o = level of observed activity
2. Let X^d = level of desired activity
3. Then X^d/X^o = rates of desired to observed activity.
   = Expansion Factor = k

By observed activity we mean the values of output and resource requirements derived at the development or field test site. These will be based on actual experience. The Expansion Factor can then be applied to all observed values of resource requirements, costs, and money payments in order to produce estimated values.

That is, suppose that observed upper and lower exploratory estimates are denoted by

4. E_L^o = Lower observed exploratory estimate, and

5. E_U^o = Upper observed exploratory estimate,

then the estimates for desired levels of activity using the expansion factor are produced as follows

6. E_L^d = Lower desired exploratory estimate,

7. $E_L^d = (k)(E_L^o)$;

8. E_U^d = Upper desired exploratory estimate,

9. $E_U^d = (k)(E_U^o)$.

In estimating the incremental estimate one proceeds similarly. Estimation starts with the observed level of activity as outlined in the previous section (I). The result will be

10. e^{o}_{L} = Lower observed incremental estimate

e^{o}_{U} = Upper observed incremental estimate

The estimates for the desired levels of activity are produced, as above, through application of the expansion factor, k. That is,

11. $e^{d}_{L} = (k)(e^{o}_{L})$, and

$e^{d}_{U} = (k)(e^{o}_{U})$.

This approach relies on a major assumption. It assumes either

a. That all resource requirements and costs change in direct proportion to the level of activity, or

b. That, while each resource requirement and cost does not change in proportion to activity, the aggregate effect on cost is proportional

In analysis of this problem one must define the context. Is the analysis one of long run behavior? In this case, the choice situation is taken to be one in which the decision maker has full freedom in specifying the kinds and quantities of all resources needed to best attain the desired level of output activity. Or is the analysis one of short run? In this case, the choice situation is restricted; the decision maker does not have full freedom to specify the kinds and quantities of some resources. Some must be taken as given. The usual example is output expansion under conditions where building and fixed equipment may not be changed.

In short run analysis most studies show that average cost varies with output. The usual textbook relation is assumed to be U shaped. Average costs first decline and then increase. This result is due to the interaction of average cost due to fixed resources and of average cost due to variable resources. Average fixed cost diminishes as output activity increases; fixed costs are spread over more units. Average variable costs first decline and then increase. This is due to one resource having less and less of the other to work with beyond some optimal production proportion. At some point the increase in average variable costs exceeds the decrease in average fixed costs and total costs rise. Not all evidence supports this statement; some studies find constant average costs over an extensive range of output activity. Under the former condition, application of the expansion factor, k, to observed estimates will be in error. In the second case, that of constant average costs, the application of the expansion factor produces accurate estimates.

In the analysis of cost when long run analysis applies, the decision maker is no longer perceived as adapting a given facility to changed levels of output activity. Instead the problem is perceived as one of choosing the optimal facility.

The usual assumption in analysis of long run cost behavior is that if all resources are doubled, then output doubles. This is called constant returns to scale. In this case application of the expansion factor produces acceptable results. Many studies confirm the above assumption.

It is our feeling that the problem studied in this section is a long run problem. The adopter is choosing a desired level of output activity and also the best arrangement for providing that level of service without constraint. Two other factors need consideration. These are the following:

a. The presence of indivisibilities.
b. The response of estimates due to the method used in the preceding section.

    1. Effect on design and evaluation of changes in output activity.

    2. Incrementally "free" resources.

Indivisibility is the characteristic of commodities that refers to the degree to which they are divisible. A resource is divisible if it is possible to procure it in any fractional quantity. Gasoline, butter, and electricity are infinitely divisible. Commodities which are not infinitely divisible are said to be indivisible. They can be obtained only in whole, nonfractional, units. The presence of indivisibilities imposes discontinuities in resource requirements and cost response. Some indivisibilities are institutionally imposed: While it may be possible to hire a staff member for any number of hours (e.g., a babysitter), institutional regulations may prohibit hiring of staff in quantities other than full or half days. The result is that resource requirements become invariant over ranges of output activity. In the case of career education projects, the number of staff will not change over certain levels of students or clients. The acceptable case or student load for a full time staff member may be defined, for example, to be anywhere between 35 and 80 individuals. In that case resource requirements for such staff may not change when activity is increased. (For example a change from 35 to 70 students will not require additional staff.) A change of enrollment from its present (observed) level will result in a change of staff employment which in no case exceeds the proportionate change in output activity. This means that

$$0 \leq \text{Staff Expansion Factor} \leq k$$

The actual change will depend on the upper (e.g., 70) and lower value (e.g., 35) of student staff ratio and the value of the actual observed ratio (e.g., 35 or 65).

Our estimation methods for observed program behavior must also be considered. The first of these is the formation of upper limit estimates based on the inclusion of Design and Evaluation activity in the estimate as well as the prorated shares of two other categories of activity. The second is the construction of estimated incremental costs wherein the adopter reduces resource requirements to the degree that such cost (zero cost) resources are available to him.

In the first case, one must ask whether the levels of design and evaluation activity present at the measurement site would increase proportionately to increases in the number of students or clients to which the developmental program is applied. To what degree will the number of students affect design activity? To what degree will the number of students affect the level of evaluation activity?

Also included in the estimation process are the prorated shares of Staff Recruitment and Training and of General Management, Housekeeping and Clerical. To what degree can these be expected to change in response to changed student enrollment?

Secondly, in the construction of *incremental* estimates, the adopter has adjusted resource requirements by subtracting the quantities of those resources available to him at no cost. The remainder constituted *his* incremental cost. Where resources are available to the adopter, the incremental cost estimate may be expected to more than double in response to a doubling of total resource requirements.

A. Exploratory Estimates

Exploratory cost estimates will be based on several assumptions.

1. We assume that application activity is proportional to the expansion factor, k.

2. We assume that increasing the level of output activity will not directly affect the level of Design or Evaluation.

3. The consequence of this is that an increase in output activity will increase Staff Recruitment and Training activity by k times $L^{*}_{..2}/L^{*}_{..8}$.

1. Operating Costs

To construct the exploratory estimate of operating costs the upper and lower estimates based on the observed level of output activity are formulated. The result is denoted as in statements 4 and 5, E^{o}_{L} and E^{o}_{U} where the "o" superscript denotes observed values.

The lower exploratory estimate of operating cost at the desired level of output activity is formulated by

$$E^{d}_{L} = (k)\,(E^{o}_{L})$$

as in statement 7.

The consequence of our assumptions is that the upper exploratory estimate of operation cost at the desired level of output activity is formulated by

13. $E^{d}_{U} = (k)\,(E^{o}_{L}) + (E^{o}_{U} - E^{o}_{L})$, or

14. $E^{d}_{U} = E^{o}_{U} + (k-1)\,(E^{o}_{L})$.

2. Acquisition Costs

An identical process is employed. Acquisition tasks are formulated on the basis of operational requirements. Resource allocations and costs are assigned. The lower estimate is increased a factor of k. The upper estimate is increased adding (k-1) (E^{o}_{L}).

B. Incremental Cost Estimate

The same assumptions apply to the incremental as to the exploratory estimate. Also, the same procedure will be applied to operational and acquisition costs.

The reader should refer to Chart III, page 61. Denote the observed value for each estimated quantity entered in Column (2) as

15. $(Q_L^d)_i$ = The lower observed resource quantity estimate for the ith resource, and

16. $(Q_U^o)_i$ = The upper observed resource quantity estimate for the ith resource.

The desired lower and upper resource quantity estimates are denoted as

17. $(Q_L^d)_i$ = The lower desired resource quantity estimate for the ith resource and

18. $(Q_U^d)_i$ = The upper desired resource quantity estimate for the ith resource,

and are calculated as follows,

19. $(Q_L^d)_i = (k)\ (Q_L^o)_i$

20. $(Q_U^d)_i = (Q_U^o)_i + (k-1)\ (Q_L^o)_i$

These values are entered in a chart of the same format as Chart III in the columns headed as Estimated Quantity. There will be a chart for each of the lower and upper estimate calculations.

From this point the procedure is the same as applied for the exploratory estimate in the preceding section. The adopter enters the number of positions in the columns headed Estimated Gross Positions. The next step is to impose judgment upon these, and enter the result in the column headed Adjusted Gross Positions. The quantities of resources available from adopter supplies at no incremental cost are specified and entered as before. These values are subtracted from gross position requirements to determine net position requirements, the value of which is entered in the column of that heading. The effective adopter wages and prices are applied to the net quantities to determine the estimated incremental costs.

In the case of acquisition requirements the point of departure is the data of Chart II. Acquisition tasks are listed and the quantity of each kind of resource estimated according to statements 19 and 20. The quantities are totaled for each resource and entered in the Estimated Quantity column in Chart III. From that point on the process is the same.

Again the method of procurement of capital resources will determine whether they are costed as an operational or an acquisition cost or included as an incremental cost at all.

III. Estimation of Service Delivery Costs Under Condition of Changed Program Configuration

By program configuration we mean the level of activity established for each kind of treatment service (or production procedure) and planned outcome. In the previous sections, it was assumed that either

1. the program was to be duplicated exactly as found at the development site or

2. the program was to be expanded or contracted in a proportionate manner such that its relative emphasis on student services and treatments and/or student behavioral results was unchanged.

An adopter may, however, wish to provide more or less of, or to eliminate, any given treatment. Likewise he may desire to expand, contract, or eliminate a particular student behavior result. This section discusses the estimation of cost when the adopter manipulates the services rendered to, and results expected of, students. The only restriction is that while some services and expected results may be eliminated no new service or expected result may be added.

To approach this problem, the degree of detail of data collection and computation must be expanded. Much of the added detail can be superimposed upon the system described in the previous chapter. In particular, the system must record the allocation and cost of resources allocated to program services and expected results. These will often be easily associated with the subproducts of the primary development product.

The specification of data collection in terms of program services and expected results coincides with the requirement to fully explain program operation to the adopter. It is exactly these services and expected results that should comprise the terms of program explanation and instruction to the adopter, even in circumstances where cost estimation is not an objective. A data collection system expressed in the same terms provides additional information — staff and nonstaff resource allocations together with an operational statement of personnel job task descriptions for the accomplishment of each program service.

Program services and expected results will differ from program to program. Therefore, the services and results specified for data collection will be unique to each program. A first task in the design of the data system is to carefully describe program services and expected results.

The illustration of program subproducts and secondary products offered in Chapter Three was based on the EBCE development projects. That project will continue as the basis of illustration in this chapter.

The dimensions and the elements of each are similar to those discussed in Chapter Three. One dimension is that of research and development activities. A second is that of resources. These are unchanged. The third dimension is that of subproducts and secondary products. It is this dimension which must be expanded to accommodate the services and outputs of the program.

Chart IV lists the elements of this dimension. The expected results are basic skills, life skills, and career development. The remaining categories are treatment elements and services of the program. The characteristics of the data collection system in terms of reporting of resource allocation are the same as those discussed in Chapter Three.[1]

The data collected in terms of this framework can be organized into two formats, one oriented toward program operation and the other toward acquisition. As before, acquisition requirements are often derived from operational requirements. Charts V and VI are illustrative. These should be compared with Chart II of Chapter Three. It will be seen that the categories recommended here generally represent a further detailing of development subproducts. For example, the services listed under execution include the basic skills, life skills, and career development subproducts. The process of execution is an element of instructional system and the means includes substantial aspects of guidance.

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1. See page 61, Chapter 3.

CHART IV

EBCE Program Services and Services by Output

Program Services to Students

1. Student Recruitment and Selection
2. Student Orientation
3. Long Range Planning
4. Short Range Planning
5. Execution (by Results)
6. Exploration Level - basic skills
7. Exploration Level - life skills
8. Exploration Level - career development
9. Learning Projects - basic skills
10. Learning Projects - life skills
11. Learning Projects - career development
12. Specialization Level - basic skills
13. Specialization Level - life skills
14. Specialization Level - career development
15. Single Objective Projects - basic skills
16. Single Objective Projects - life skills
17. Single Objective Projects - career development
18. Personal Affairs and Problems
19. Progress Monitoring and Assessment

Facilitating Services

20. Community Resources - recruitment and development
21. Governance - recruitment and formation
22. Governance - conduct of effort
23. Program Materials Development
24. Staff Recruitment and Training

Support Services

25. Transportation - acquisition
26. Transportation - operation
27. Food Services - acquisition
28. Food Services - operation
29. Legal Operation - acquisition
30. Legal Operation - operation
31. Student Insurance - acquisitions
32. Student Insurance - operations

In any case, our purpose here is not to defend in detail this particular conceptualization of the system but to illustrate the requirement that a composite set of program services and results be defined and that the description not conflict with, and indeed enhance the structure of subproducts used for program development budget and accounting reporting.

At this point, before we suggest the method for providing the desired estimates, a word of caution. The estimation of costs under varied services and levels of results will be extremely precarious for any program, when the only available data is that of development experience, even if augmented by field testing data. Statistical estimation would require the obeservation of the program in many different settings. Then an estimation formula could be fitted to that experience.

All of the problems mentioned before apply. The most basic of these is the presence of indivisibility and fixity of resources. For such resources a change in the level of program activity simply will not occasion a proportionate change in indivisible or fixed resource requirements and costs compared with development experience. There may be no change at all. That is why all estimates based on prorations have to be considered as suspect and subject to modification in light of judgment. Chart III provides for application of that judgment. The problem of change in fixed and indivisible resources continues to apply when the focus shifts from the program to its component services and expected results.

An additional problem concerns the interdependencies among program services and results. The several treatments and services are not independent of one another. For example, even supposing that we know the resource requirements and costs of providing student treatment through learning projects, one would be hesitant to predict that doubling the level of this service would result in total program costs being increased by an amount equal to that of current learning project costs. Secondary effects would modify that estimate. For example, community resource recruitment and program material development costs would increase since they are necessary intermediate inputs to the provision of learning projects.

A third problem concerns joint products. Joint products are two or more products which are so intimately associated that they cannot be produced independently. We have assumed that basic skills, life skills, and career development represent three kinds of results and that they are independent of one another. To the degree that this assumption is in error it will not be possible to discuss the change in cost occasioned by the independent adjustment in the level of one intended result.

The method of estimation is an application of that discussed in the previous two sections. The procedure is as follows:

1. The cost of the program in its development configuration is estimated at the desired level of program activity. This requires application of the procedures discussed in Sections I and II.

2. The changes in program configuration are specified. We have illustrated this by suggesting that the student body complete twice as many learning projects. Another illustration would be elimination of basic education from the program.

3. The quantities of resources which can be directly traced to the affected program elements must be identified. This can be done by tracing resource allocations to the combinations of treatment/result and research and development activity illustrated in Charts V and VI. There will be an upper and lower estimate of allocation as employed previously in Section I.

4. The program structure should be examined and induced changes in any other program elements estimated.

5. The procedures discussed in the previous two sections are applied to the changed resource requirements in order to estimate the change in cost.

6. This value is added to the cost of the program in its development configuration and desired level of activity (Step One.)

To recapitulate, in order to produce a lower exploratory estimate of the operational cost of the effects induced by the change in program configuration, the changed resources requirements are those derived from Application activity plus prorated Staff Recruitment and General Management. The upper exploratory estimate adds those operation resources allocated to Design and Evaluation activity, with prorations similar to that of application activity.

To provide an exploratory estimate of acquisition costs, the effect of the changed configuration of services upon acquisition requirements must be determined. Data on the quantities of resources augmented by measures of the result of allocation of those resources will be useful. For example, one must establish the connection between the desired number of learning projects, the probable number of community

Chart V

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CHART V: OPERATIONAL RESOURCE REQUIREMENTS OPERATIONAL INPUTS OPERATIONAL OUTPUTS	PERSONNEL RESOURCES												NON-PERSONNEL RESOURCES												NON ADOPTER RESOURCES	
	Program Director	Secretarial	Clerical	Sr. Learning Coordinator	Learning Coordinator	Sr. Employer Rel. Spec.	Employer Rel. Spec.	Counselor	Res. Center	Sch. Dist. Teachers	Consultants Tech. Asst.	Other (Specify)	Facilities	Utilities	Telephone (Local)	Telephone (Long Dist.)	Transportation	Office Equip.	Office Supp.	Reproduction Services	Purchase Price				Student.	Employer
PROGRAM SERVICES TO STUDENTS																										
Student Recruitment and Selection																										
Student Orientation																										
Long Range Planning																										
Short Range Planning																										
Execution (by Results)																										
Exploration Level -basic skills																										
- life skills																										
- career development																										
Learning Projects -basic skills																										
- life skills																										
- career development																										
Specialization Level-basic skills																										
- life skills																										
- career development																										
Single Objective Proj.-basic skills																										
- life skills																										
- career development																										
Personal Affairs and Problems																										
Progress Monitoring and Assessment																										
FACILITATING SERVICES																										
Community Resources & Recruitment																										
Governance-Recruit. & formation																										
-Conduct of effort																										
Program Materials Development																										
Staff Recruit. & Training																										
SUPPORT SERVICES																										
Transportation - acquisition																										
- operation																										
Food Services - acquisition																										
- operation																										
Legal Operation - acquisition																										
- operation																										
Student Insurance - acquisition																										
- operation																										
GENERAL MANAGEMENT, ETC.																										

CHART V

Chart VI

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Chart VI Acquisition Requirements Acquisition Resources ACQUISITION TASKS	PERSONNEL											NON-PERSONNEL RESOURCES												NON-ADOPTER RESOURCES	
	Program Director	Secretarial	Clerical	Sr. Learning Coordinator	Learning Coordinator	Sr. Empl. Rel. Spec.	Employer Rel. Spec	Counselor	Res. Center	Sch. Dist. Teachers	Other Consultants (Specify)	Facilities	Utilities	Telephone (Local)	Telephone (Long Dist.)	Transportation	Office Equip.	Office Supp.	Reproduction Services	Purchase Price	Other	Other	Other	Student	Employer
ACQUIRE HUMAN RESOURCES																									
Recruit/Select Students																									
Recruit/Select Community Resources																									
Recruit/Train Staff																									
Recruit/Form Governance Board																									
ACQUIRE PROG. Mat'l & SUPPLIES																									
Learning Packages																									
Cross Reference File																									
Other (Specify)																									
ACQUIRE LOGISTIC SUPPORT																									
Transportation																									
Insurance (Student)																									
Legal Relations																									
Food Services																									
ACQUIRE OFFICE EQUIP. & SUPPLIES																									
(Specify)																									
ACQUIRE AND ARRANGE OCCUPANCY																									
Facilities (Specify)																									
UTILITIES																									
Telephone																									
ACQUIRE OTHER CAPABILITIES																									
(Specify)																									

~~CHART VI~~

resource contacts that must be made to yield the desired quantity, and the probable number of program resources required to contact employers and other managers of community institutions. After the acquisition requirements have been specified, the upper and lower exploratory estimates are derived as before.

To produce upper and lower estimates of incremental costs, the process is similar. Resource changes must be specified. However, the detail is again greater, since the adopter must know the physical quantities of each resource in order to determine his requirements net of those already available to him. Following the upper and lower estimate of resource requirements, resources available at no adopter cost are eliminated and the appropriate wages and prices characteristic of the adopter market applied.

IV. Summary

Chapter Four has discussed the estimation of service delivery to potential adopters. One kind of estimate was the exploratory estimate. This estimate was based on national averages of adopter prices and wages and included all resources. An upper and lower exploratory estimate was suggested. The lower estimate was based on the development activity of Application. The upper estimate included two other activities as well, Design and Evaluation. However, only the Design and Evaluation of operational staff are included. Exploratory estimates of operational and acquisition costs were discussed. Acquisition costs were derived from operational requirements and required data on the results of staff efforts as well as the allocation of other resources to those efforts.

The incremental estimate is the second kind of estimate. This estimate took account of the possible presence of resources which may be available at no cost to the adopter. These were subtracted from total resource requirements included in the exploratory estimate. Prices and wages typical of adopter markets were applied. Again upper and lower estimates were calculated for acquisition and for operational costs.

A procedure for providing these estimates was outlined for each of three conditions:

1. That in which the adopted program identically duplicates the program in its developmental setting in terms of program service configuration and level of service activity;

2. That in which the scale of the program activity could be increased or decreased, but in which program service configuration did not change; and

3. That in which service configuration was allowed to vary in addition to level of activity.

Substantial difficulties stand in the way of accurate estimates in the latter two circumstances. Estimates must be used cautiously, and not too much can be expected. The estimator needs to be especially aware of resources which do not change or do not change continuously with changes in level of program activity and of interdependencies among kinds of program service and among kinds of program results. However, approaches to each were suggested, and we feel they have merit, given the difficulties.

As we progressed through the chapter, the reporting system of Chapter Three was modified. Changes were made in the categories included as subproducts in that chapter. These were redefined as program services and output results. The result was an increase in the detail with which subproducts were formerly identified. However, the service/output configuration is consistent with the less detailed subproduct structure. It merely builds upon, but does not replace, the previous structure of data reporting. We suggest use of the more detailed structure since it will meet a broader set of requirements. It facilitates estimation of cost for a variety of circumstances, continues to provide for program budgeting accounting reporting, and strengthens the process of explanation and instruction to adopters.

Chapter Five

DESCRIPTION AND ASSESSMENT OF MODEL II

INFORMATION SYSTEM

(Experience Based Career Education Program—AEL, Charleston W. VA.; Berkeley, Calif.; NREL, Portland Ore.; RBS, Philadelphia, Pa.)

In this chapter we will discuss the four Model II sites. Where useful, we will point to differences among the individual sites. However, for the most part, we shall treat them as a group. This is justified since there has been a great amount of common effort among the sites and since a coordinated effort in cost reporting is underway. A common meeting of laboratory staff, Washington staff, and consultants in Chicago, Illinois, on October 11 and 12 for the purpose of arriving at common cost reporting definitions, characterizes that effort.

I. Program Description

Model II generally provides career education to students[1] at the eleventh and twelfth grade level. EBCE students are recruited from among those enrolled in the traditional high school program.

The objectives sought by EBCE are to foster learning, personal development, and career awareness through contact with the adult working world. Students who complete this program are to be as well qualified in those skills developed by the traditional school programs as are students in those programs. In addition, the EBCE student is to be more competent in career related skills and in the ordinary life skills (e.g., financial skills) necessary for coping with adult life in an urban setting. In comparison with the goals of Model III (enrollment in training or return to the labor force) or Model IV (placement), the objectives of Model II are therefore, much more numerous and, generally, less specific. In this, Model II goals are characteristic of educational goals in general and subject to all of the difficulties which beset those goals. This does not deny the specificity by which individual behavioral objectives are defined (e.g., to be able to count by tens from zero to one hundred). We believe that such goals are intermediate relative to the ultimate concerns of educators and students. They are more analogous to product specifications than products. Also, these specific goals are less distant to ultimate student choices than some other objectives (e.g., to find a job within six months of graduation, to earn a self-sufficient income, to have a rewarding career, or to live within one's means).

---

[1] Models III and IV are primarily adult, non-student, oriented.

EBCE not only emphasizes a difference in result, increased career awareness. It is also distinguished from traditional school programs by the process through which these results are obtained. EBCE is to attain its results through maximum reliance upon *non-school community resources and institutions*. In its most extreme and idealistic statement the process is described as one in which all learning takes place in a work or employment related setting. We now turn to a description of the EBCE process.

In Chapter Four, we referred to the necessity of recording costs in terms of program processes and results. The first series of services in this process are those that focus directly upon students and upon the changes in them that define the output of EBCE. Students come into initial contact with EBCE through *recruitment*. In recruitment, staff present the program and solicit student entry. Subsequent to recruitment, *initial assessment* takes place. If students meet program requirements, they are admitted.

New students must attend orientation. In the service called orientation two distinct activities take place. The first is true *orientation*. By function, orientation provides a full explanation of program goals, procedures, and requirements, with opportunity for clarification through student-staff discussion. The second activity is one which collects data describing the present state of the students. That data is obtained through existing student records, through testing, and through interviews with the student. This second segment of the orientation program is in fact the transition into, or the first step in, the next stage, *long range planning*. Long range planning is a process "of comparing where the student is now—his interest, value, career and education goals, current levels of achievement, and courses and credits completed-" as determined above "with where the student wants to be - what the student wants to learn (about himself or other things) or what he wants to learn how to do, what skills or knowledge he should develop to pursue his current career and educational goals, what course and credit equivalences he needs to meet school graduation."[1] The time horizon which defines long term planning is not unambiguously specified— "semester *or* (italics are ARIES') year." The result of such a process is a statement of long-term objectives broken down into a sequence of shorter term actions which are admittedly tentative but which would, in sum, accomplish the results which are the terms of the long-range plan.

Short range planning (period planning) follows long range planning. Here the general objectives of the most immediate of the several periods of the long-range plan are given more specific content in terms of definite actions that will be taken. In the context of the short-range plan the student and staff agree on specific learning packages, programs, and projects and the specific experience through which student work will be accomplished.

Execution consists of all activities which facilitate student accomplishment of short-range program objectives. These may be broken down into subactivities such as instruction, specification of learning experiences, and placement of students in employer sites. As understood here, execution does not include *monitoring* and assessment of student progress. This activity consists of all those actions by which student behavior and his work and performance is evaluated. *The services of long-range planning, short-range planning, execution and monitoring and assessment, when taken as a group, are a recursive process.* Based on the results of the current period as determined through monitoring and assessment, long-range plans are revised, a new short-range plan formulated, and a new period of execution begun.

---

1. Employer-based Career Education Operating Plan FY 1974, Far West Laboratory for Educational Research and Development, 1855 Folsom Street, San Francisco, California 94103; P116.

The services described above are (1) rendered directly to students and (2) produce output related results. Other EBCE services either are not rendered directly to students or do not render services to them which directly produce output-related results. Transportation and food services are illustrative of two such services found both in EBCE and in traditional school programs. At this point we wish to mention two other services, both of which provide unique resources necessary to EBCE—experience sites and resource persons and experience-based learning packages. EBCE staff obtain and develop these resources through services which we shall call experience institution recruitment, resource site and person identification and analysis, and learning package development.

The structure of EBCE services is portrayed in Chart I. In the diagram, students are indicated by Ⓢ, experience sites and resource persons by Ⓔ, and learning materials by Ⓛ. The diagram is not meant to be a complete flow diagram. In particular, decision rules have been omitted. The chart is a simple listing of essential EBCE services, portraying their general relationship to one another. School budgeted EBCE resources (e.g., staff, facilities, equipment) are not indicated. It is taken as obvious that the services discussed above and services listed in Chart I are provided through EBCE staff, materials, equipment, and facilities. One task is to allocate these resources and their costs among program services described above and portrayed in Chart I.

II. Description of the Accounting Systems

A. Reporting Categories

The line item categories for objects of resource payments of the Model II sites are very similar. The categories are listed in Chart II. No attempt has been made to describe the relations which exist among the categories of several Model II sites. It should be clear that relocation expenses, which occur under transportation of persons in Column 1 of Chart II, must be included somewhere among the categories found in the remaining columns, supposing that the expenditure occurs.

Chart I: Schematic of EBCE Process.

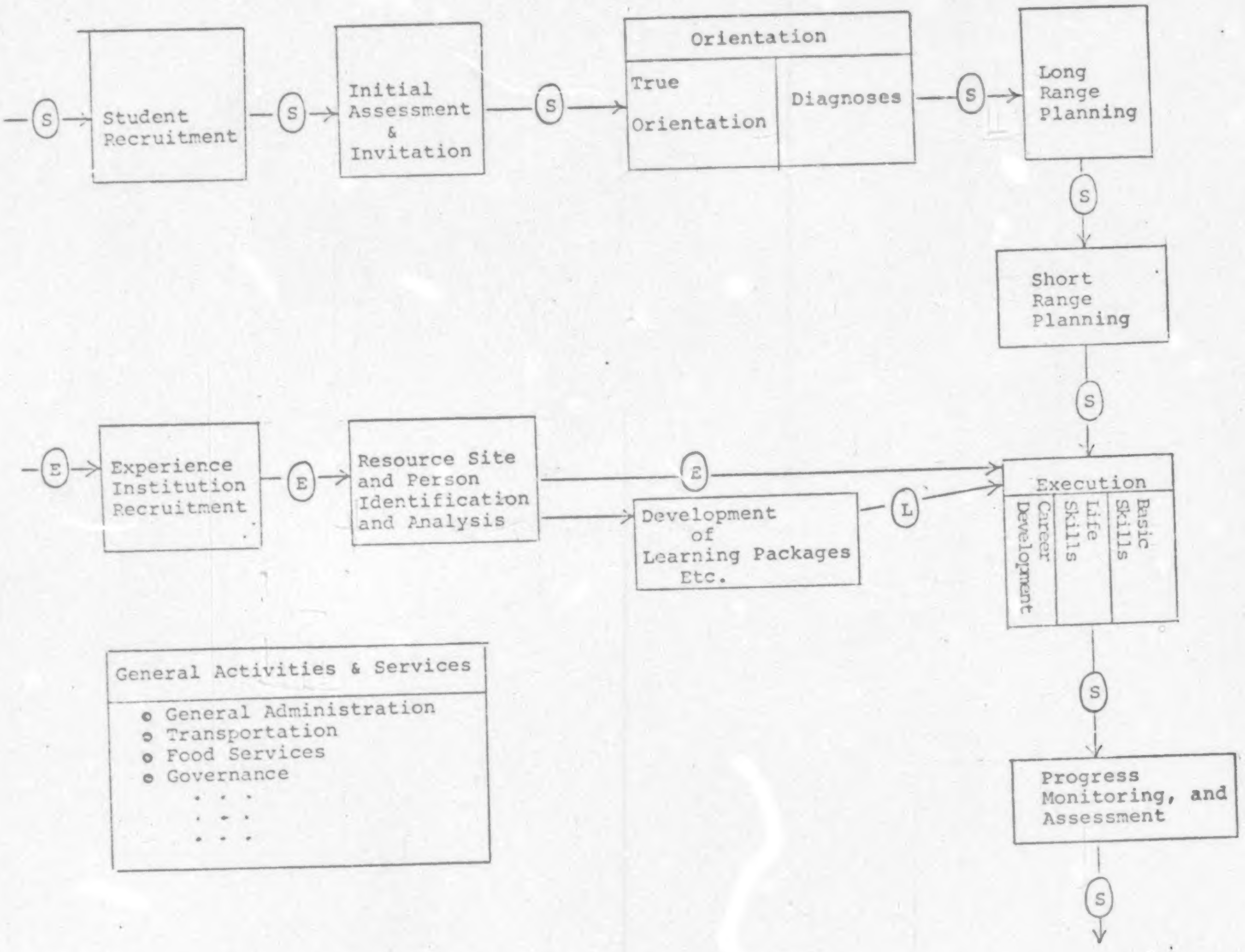
S
Student Recruitment
S
Initial Assessment & Invitation
S
Orientation
True Orientation
Diagnoses
S
Long Range Planning
S
Short Range Planning
S
Execution
Basic Skills
Life Skills
Career Development
S
Progress Monitoring, and Assessment
S
E
Experience Institution Recruitment
E
Resource Site and Person Identification and Analysis
E
Development of Learning Packages Etc.
L
General Activities & Services
General Administration
Transportation
Food Services
Governance
. . .
. . .
. . .

Chart II

Model II Line Item Budget Categories

AEL	FWL	NWREL	RBS
Personal Compensation	Personal Services	Personal Compensation	Personal Compensation
Salaries and Wages	Salaries	Salaries	Salaries and Wages
Consultants	Consultants	Consultants	Consultants
Casual Labor		Other	Staff Associates
Shared-Time Person			Other
Board Members			
Conferees			
Experimental Subject			
Personal Benefits	Benefits	Personal Benefits	Personal Benefits
Travel and Trans. of Persons	Travel and Per Diem	Travel and Trans. of Persons	Travel and Trans. of Persons
Staff and Shared-Time		Staff	Employees & Staff Assoc.
Consultant		Consultants	Consultants
Other		Other	Students
Conferees			
Board Members			
Relocation Exp.			
Transportation of Things		Transportation of Things	Transportation of Things
Postage			
Freight			
Rental of Comm. Vehicle			

Chart II
(Cont.)

AEL	FWL	NWREL	RBS
Rent, Comm. & Utilities		Rent, Comm. & Utilities	Rent, Comm. & Utilities
Facility Rental	Facility Rental	Facility Rental	Facility Rental
Equipment Rental		Equipment Rental	Equipment Rental
Telephone and Telegraph		Telephone	Telephone and Telegraph
Utilities and Janitor	Utilies and Equipment Rental	Utilities	
Printing & Reproduction		Printing & Reproduction	Printing and Reproduction
Printing		Printing	
Reproduction		Reproduction	
Other Services	Other Services	Other Services	Other Services
Data Processing		Data Processing	Data Processing
Subcontracts and Agreements	Subcontracts	Subcontracts	Subcontracts
Conference Exp.		Conference Exp.	Conference Exp.
Media Service Center	Media Services	Other	Other
Equip., Repr., Mnt.			
Professional Services			
Insurance and Bonds			
Miscellaneous			
Supplies and Materials	Supplies and Materials	Supplies and Materials	Supplies and Materials
Office Supplies		Office Supplies	Office Materials
Printed Materials		Printed Materials	Printed Materials

Chart II
(Cont.)

AEL	FWL	NWREL	RBS
Other Program Supplies		Other	Other
ERIC Materials			
Equipment	Equipment	Equipment	Equipment
Program	(Listed)	Program	Program
Office		Office	Office
Total Direct			
Indirect		Indirect	Indirect
	Fee Objectives		
	G & A		
	Subcontract Adm.		
Total	Total	Total	Total
		Management Fee	

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We have seen that considerable similarity exists among the line item cost categories of several laboratories. Comparability, however, of cost treatment in terms of assignment of costs to categories is of equal importance. Differences are frequent, as the following illustrates. First, costs and expenses may be reported on the basis of cash flow or accrual. In many cases, the two treatment procedures are identical, as in the case of salaries. In other cases, the two are not identical, as in the case of staff vacation and sick leave benefits. Treated as a cash flow, these benefits are charged as taken. Treated on an accrual basis, the costs of these benefits are charged as they are earned. In the treatment of these benefits, one laboratory charges them on a cash flow basis whereas other labs charge them on an accrual basis.

The assignment of telephone charges provides another illustration. Here, RBS charges local and general (switchboard equipment, etc.) charges on the basis of gross staff salaries; NWREL charges based on the number of telephones. Rent charges provide a final illustration. Here, FWL lab does not include a rental charge for its facilities under the rental category. Instead, these charges are included in the category of indirect costs. NWREL does include rental charges for its facilities, as well as those for which it contracts separately, in the rental category.

FWL, NWREL, and RBS allocate line item costs into development, operations, evaluation and replication. Chart III lists these categories as derived from the operational plans of the laboratories and from materials gathered during visits to development sites.

Chart III shows that NWREL includes additional categories, but it is easy to see how these relate to those found in systems FWL and RBS. The potential for definitional differences exist. FWL defines operations to be... "all costs associated with the operation of the pilot EBCE program." This includes all costs for administration, instruction and guidance, resource maintenance, and student records. Administration includes facilities, equipment, transportation for staff and students, insurance, provision for health and safety, and for advisory boards. This definition differs from that of

Chart III

Research/Development Cost Reporting Categories

AEL	FWL	NWREL	RBS
None	1. Formative Evaluation Research & Evaluation	1a. Formative Evaluation 1b. Summative Evaluation	1. Evaluation
	2. Replication/ Documentation	2a. Product Development/ Dissemination 2b. Replication Prospectus	2. Replication
	3. Development	3. Development	3. Development
	4. Operations	4. Operations	4. Operations
	5. Research and Summative Evaluation	5. Administration	5. Other, e.g., General Administration

operations found in RBS where we find that... "operations performs the following functions... implementation of field testing; direct servicing of student needs; and identification of design/development deficiencies." The equivalence of these two definitions is not obvious, and in fact that of RBS implies a greater probability that some evaluation and design activity may qualify as operations in comparison to FWL.

None of the systems makes provision for collection of the costs which are associated with the remaining research and development activities referred to in Chapter Three.

The three laboratories which go beyond line item accounts also provide cost breakdowns beyond those shown in Chart IV. These are displayed in Charts IV, V, and VI.

Chart IV

FWL Reporting Categories

System Planning and Design

    Formative Evaluation

    Documentation

    Development

Development of Learning Resources

    Formative Evaluation

    Documentation

    Development

Development of Curriculum Organization

    Formative Evaluation

    Documentation

    Development

Development of Student Related Procedures

    Formative Evaluation

    Documentation

    Development

School Operations

Research and (Summative) Evaluation

Chart V

NWREL Chart of Accounts

School Contract

    Dissemination

    Development

- Governance
- Management
- Instructional System
- Basic Skills
- Life Skills
- Careers
- Guidance
- Employer Utilization

    Operations

Laboratory Contract

    Development

- Governance
- Management
- Instructional Skills
- Basic Skills
- Life Skills
- Career Development
- Guidance
- Employer Utilization

- Formative Evaluation
  - General
  - Governance
  - Management
  - Instructional Systems
  - Basic Skills
  - Life Skills
  - Career Development
  - Guidance
  - Employer Utilization
- EBCE Stabilization and Replication
- Summative Evaluation
  - General
  - Governance
  - Management
  - Instructional Systems
  - Basic Skills
  - Life Skills
  - Career Development
  - Guidance
  - Employer Utilization
- Product Development/Dissemination
  - General
  - Governance
  - Management
  - Instructional Systems

  - Basic Skills
  - Life Skills
  - Career Development
  - Guidance
  - Employer Utilization
- Cost Installation Study - Milestone #1
- Replication Prospectus
- Program Administration
  - September, 1973 - November, 1973
  - December, 1973 - February, 1974
  - March, 1974 - May, 1974
  - June, 1974 - August, 1974

Chart VI

RBS Chart of Accounts

- Program Administration
  - Development
  - Operations
  - Evaluation
  - Replication
  - Other
- Evaluation
  - Career Development
  - Career Guidance
  - Basic Skills
  - Supplementary
  - Other

- Replication
  - Career Development
  - Career Guidance
  - Basic Skills
  - Supplementary
  - Other
- Career Development Unit
  - Career Exploration - Development
  - Career Exploration - Operations
  - Career Specialization - Development
  - Career Specialization - Operations
  - Other Development
  - Other Operations
- Career Guidance Unit
  - Transition Program - Development
  - Transition Program - Operations
  - Personal Development Program - Development
  - Personal Development Program - Operations
  - Placement Programs - Development
  - Placement Programs - Operations
  - Other Development
  - Other Operations
- Basic Skills Unit
  - Development
  - Operations

Supplementary Program

Development

Operations

Several observations can be offered on the basis of these exhibits. First, beyond the categories noted in Chart III, the accounts are quite different. Second, the additional categories tend to describe the products of the development process rather than the components or products of the operational process. The former is commendable, but the issue of adopter costs is not fully addressed. Specifically, costs of changes in program structure cannot be addressed.

B. Cost Reporting at Model II Sites

The several models require time reports by their staff. These are presently submitted monthly at one laboratory and bimonthly at the other three. All report the percent or fraction of time devoted to each reported activity, and the base is the normal work period. The period of time which entry in the report covers also differs among laboratories. AEL requests a single statement of time allocation over the month, RBS over the bimonthly period as a whole, and NWREL requests a report for each day of the reporting period. Charts VII and VIII illustrate two approaches.

III. Assessment of Model II Reporting Systems

A. Reporting Categories

It should be clear by now that the four EBCE laboratories exhibit differences with respect to cost reporting categories and their definitions, the procedures which staff employ in time reportings, the degree to which non-personnel costs are direct costed, and the assignment formulas for indirect costs. Neither the laboratories nor NIE are unaware of these.

Chart VII

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NWREL

TIME DISTRIBUTION REPORT

Employee Signature	Employee Number 3	Period Ending Date
Approved By		

PROJECT/ACCOUNT	1/16	2/17	3/18	4/19	5/20	6/21	7/22	8/23	9/24	10/25	11/26	12/27	13/28	14/29	15/30	31	TOTAL	ACCOUNT NUMBER
																	16	21
Emergency Leave																		
Holiday																		
Annual Leave																		0 0 0 0 4 3 3
Sick Leave																		0 0 0 0 4 3 1
TOTAL																		0 0 0 0 4 3 2
Overtime Hours (Earned) Taken																		0 0 0 0 4 3 5

TO BE ACCOUNTED FOR

Period	Total Days
Dec 15	11
31	10
Jan 15	11
31	12
Feb 15	11
29	9
Mar 15	11
31	11
Apr 15	10
30	11
May 15	11
31	12
Jun 15	11
30	10
Jul 15	10
31	12
Aug 15	11
31	12
Sep 15	10
30	10
Oct 15	11
31	12
Nov 15	11
30	11

Instructions:

1) Show fractions of days as two-place decimals (i.e. 1.50, 0.75)

2) Reports to be submitted to the Division secretary by 10:00 a.m. of the day following the close of the period

3) All Account Numbers Must Be Complete - Refer to Master Account Listing - Direct questions to Accounting Department

Chart VIII

Career Development Unit

Staff Person - ______________________________

V04 Career Development Unit
Cost Centers

01 Career Exploration Development ____%

02 Career Exploration Operations ____%

03 Career Specialization Development ____%

04 Career Specialization Operations ____%

05 Other Development ____%

06 Other Operations ____%

What percentage of your time over the last pay period did you spend in the various codes?

Please submit this form to your team leader on Tuesday prior to pay day.

Chicago Meeting

In October a meeting was held in Chicago to discuss cost-related issues. A copy of the agenda is included as Chart IX. The meeting did not resolve the issues posed by the agenda. However, the following conclusions were drawn at the conference.

1. There was tentative agreement upon the following research and development categories for purposes of uniform reporting to NIE.

    a. Development
    b. Operations
    c. Evaluation
    d. Replication
    e. General Administration

2. Of the above, a definition was agreed upon for Development as follows: All design, fabrication and revisions prerequisite to providing EBCE services to students.

3. Operations was defined as follows: All activity and cost associated with the delivery and coordination of EBCE learning experiences to students. Based on the definitions a list of operational costs was developed.

    I. Enabling Costs
        A. Staff Selection
        B. Staff Training
        C. Student Selection
        D. Employer Recruitment
        E. Staff Setup and Supply
        F. Orientation

    II. Program Operation
        A. Administrative and Clerical
        B. Instructional Delivery System
            1. Basic Skills
            2. Life Skills
            3. Career Development
            4. Guidance

    III. Logistics (Transportation, Insurance, Health and Food Services)

    IV. Major Fixed Costs
        A. Rent
        B. Capital Equipment Costs

Chart IX

Agenda for EBCE Cost Conference

Chicago, Illinois, October 11-12, 1973

Thursday, October 11

8:30 a.m. A. Feasibility of a Uniform Cost Allocation System for EBCE Sites

-Discussion of current allocation practices (reference Fy '74 Operating Plans)

-Tentative decision on standard major cost categories

-Difficult issues relating to cost allocation among major categories (representatives from each site should be prepared to raise questions which will help clarify how costs should be distributed among cost categories; e.g. should any of project director's salary be prorated to operations? How should start-up costs be defined? How should rental costs be handled, particularly when overhead staff and students use the same facility?

-How should the cost information be collected and reported by the projects?

12:00 - 1:30 p.m. LUNCH

P.M. (Continuation of morning session as long as necessary)

B. Determination of comparative costs in local LEAs

-What specific questions need to be answered?

-What is the best process to get those answers (Separate contract amendment to each site? National RFP? Competition among four EBCE sites?)

-Can the EBCE cost allocation formula be applied directly to public school operations to determine per pupil costs? Will it need to be modified or expanded for this purpose?

Friday, October 12

8:30 a.m. (Continued Topic B if necessary)

C. Cost Considerations in Replication

-What will we need to tell prospective adopters regarding costs?

-Are there special cost data needs for replication which require different analysis?

-Is costing-out components feasible? desirable?

D. Cost Effectiveness Issues

-What are the cost effectiveness considerations we should be concerned about now? FY '75 beyond?

-When should formal cost effectiveness studies be initiated?

-Are there specific issues which are so importnat as to require special attention?

-Longitudinal study considerations involving costs

12:00 - 1:30 p.m. LUNCH

1:30 - 3:00 p.m. Conference Wrap-up

-Unresolved issues
-Assignments
-Good of the Order

ADJOURNMENT BY 3:00 P.M.

4. The financial officers of the laboratories agreed that, although indirect costs were allocated differently among the labs, they could compute cost data by hand in order to satisfy uniform cost assignment requirements.

5. Charts IV, V, and VI show that the category, operations, is less well detailed than those of development and evaluations. One conclusion reached by the conference participants was that operational costs should be reported in greater detail and, if necessary, that detail in other cost categories should be reduced.

Research and Development Categories

Model II as a group should be able to provide data which describes uniform research and development activities to NIE. One laboratory in particular provides a specification of the several phases of research and development activity by work units, or products. This is useful and relates costs to NIE milestones. We believe it is possible to do this with respect to the activities defined at Chicago as Development, Evaluation, and to some extent, depending on how it is defined, Replication. Within Operations, however, allocation of resources and cost to some products will be possible—for example, to governance and community resource utilization.

Other products, such as basic skills, life skills, and career development, may be difficult to separate from one another and may have to be treated as one unit. This is a consequence of an explicit goal of EBCE process, that learning activities should be blended. Other activities cannot be directly assigned to EBCE products. General administration is one of these.

The activities listed at Chicago do not conflict with the Standard Categories in Chapter Three. Their relationship is indicated in Chart X on the following page.

We belive that replacing the one category of general administration with four categories; that adding product finishing; and the replacing replication by documentation and diffusion will provide a fuller description of cost to NIE.

Chart X

Comparison of Model II and Recommended Standard Categories

Development	Design
Operations	Application
Evaluation	Evaluation
Replication	Product Finishing
	Documentation
	Diffusion
General Administration	General Administration & Clerical
	Funder Negotiation & Liaison
	Site Negotiation & Liaison
	Staff Hiring and Orientation

Service Delivery

Model II laboratories do not generally record data in a form which will be useful for estimating resource requirements and costs to potential adapters. The most useful in this regard is RBS which could break operations down as follows:

Chart XI

RBS Operations Breakdown

Operations

- Program Administration
- Career Development
- Career Specialization
- Transition Program

Personal Development

Placement

Basic Skills

Supplementary Program

However, we believe that estimation of program service delivery requirements should be based on the different and distinguishable services provided directly and indirectly to students. Chart XII based on Chart I is meant to be illustrative in this regard. It represents a useful, although tentative, beginning. In any case, operations requirements and costs should be broken down. In doing so, the categories must be constructed so as to be clearly distinguishable by reporting staff.

No laboratory has indicated that estimation of service delivery requirements will emphasize resource requirements first and costs second.

The collection of several categories of research and development activity into one, General Administration, as in Chart X may result in service delivery cost estimates which are too low if General Administration is excluded and too high if General Administration is included. Only part of that category should be included in service delivery cost estimates.

Chart XII

Suggested Service Categories for Application/Operations

A. Direct Services to Students

  1. Program

    a. Student Recruitment

    b. Initial Assessment and Invitation

    c. Orientation

    d. Diagnosis

        - e. Long-Range Planning
        - f. Short-Range Planning
        - g. Execution
        - h. Progress Monitoring and Assessment
        - i. (Placement, should it exist)
    - 2. Support
        - a. Transportation
        - b. Food Services
        - c. Health Services
        - d. Insurance

B. Indirect Services to Students

- 1. Program
    - a. Experience Institution Recruitment
    - b. Resource Site and Person Identification and Analysis
    - c. Acquisition and Development of Learning Materials
    - d. Learning Material Storage and Distribution
    - e. Staff Recruitment, Orientation, Training and Professional Development
- 2. Support and Fixed Costs
    - a. General Administration

B. Staff Time Reporting

Model II laboratories use very dissimilar time reporting procedures. We believe that no serious problems would stand in the way of uniform procedures. Uniformity would eliminate differences in cost reporting due to staff time reports.

Most laboratories report time over an excessively long period and in terms of percentages. For NWREL, which does request daily reporting by staff (although whether staff so record their activity is open to question since reports are submitted bimonthly), it appears that fractions of the day are the units of record. We, of course, believe that staff should record the actual hours devoted to various activities permitting use of an effective wage rate, and time reporting approximately contemporaneous with activity performance. No Model II laboratory does this.

C. Allocation of Indirect Costs

As the Chicago meeting disclosed, Model II laboratories treat the assignment and allocation of non-personnel costs quite differently. This may be a consequence of each laboratory having to satisfy several fundors. It is also due to cost treatment conventions agreed upon by the particular agent of the government and the laboratory at the time of their initial relationship. The government will be represented by one of many agencies so that not all laboratories are necessarily accountable to the same one in formation of accounting conventions. Fortunately, the laboratories have expressed willingness to make special calculations in order to satisfy NIE desires for uniform accounting.

Direct assignment of costs should procede further. Specifically, rent of facilities owned by the laboratory and associated utilities should be directly charged, as should employee benefits, instead of absorbing these costs into an indirect cost pool to be assigned on a prorated basis. No laboratory assigns a capital use charge for use of equipment previously purchased. Such equipment is charged on a cash flow basis. This is not a significant concern when reporting total program costs of research and development to NIE. It becomes an issue when separating total cost into its elements, when estimating adoptor requirements costs, and when conducting cost/effective and cost/benefit analysis.

When laboratories break down program costs into smaller activities, of which development is an example, there is no clear indication as to the costs which are unambiguously direct to the activity and those which are indirect. A reporting scheme which reports direct costs by category and indirect costs by category with footnotes to specify the particular cost pool of assignment and the proration formula would be useful to recipients of the report. Also, since indirect costs are likely to be fixed over some range, their identification would aid an adopter reader in assessing the degree to which costs would change in response to changes in the particular program activity.

IV. Summary

In summary, we belive that Model II laboratories have in operation or are moving toward a structure of accounting categories for reporting research and development costs to NIE which are similar to, but will stop short of, that specified in Chapter Three. In our opinion, more detail should be obtained in the area of costs which are not direct to any particular research and development activity or product.

At present, the laboratories have little ability to estimate operational requirements or cost beyond the simple total operational cost component of their report system. This is not a serious problem, since as mentioned elsewhere the operational resources and costs of program operations are expressed in terms of cost per month. That is, if the proper categories and procedures are established in the near future, the basis for describing operating costs of program operations can be established and applied in time to obtain operating cost measures.[1] The same applies for acquisition costs if a full field test of EBCE programs takes place in new settings.

Operational activity needs to be defined in terms of its production process, and, if possible, its output results.

We found that most interest in the area of adopter service delivery centers on costs rather than physical resource requirements. We have emphasized in Chapter Four that for purposes of adopter estimation of cost, it would be for more useful to focus primarily upon specification of resource requirements and upon costs secondarily. This is due to the difference in resource prices, resource availabilities, and accounting practices among potential adopters.

---

[1] However, since the level of activity and, therefore, cost fluctuates among program components throughout the year, it is preferable to have a full year of measurement.

We believe that for many Model II laboratories, the direct costing of resources should proceed further, at least in the case of facilities. Further, reports should make clear which charges are direct to the cost category under study (e.g., evaluation) and which are indirect. The allocation procedure for indirect costs should be noted.

When reporting physical resource requirements a parallel procedure should be followed. The ratios of resource requirements should be clearly specified. For example, if one learning coordinator is necessary for 50 students, that should be clearly stated.

More than any other NIE career education model, EBCE requires the allocation of resources external to its payments system. Meaningful implementation of EBCE requires placement of significant number of students at public and private institutions which are to perform significant educational duties. This practice is bound to impose significant costs upon these institutions.

Chapter Six

DESCRIPTION AND ASSESSMENT OF MODEL III INFORMATION SYSTEM

(Telephone Counseling Career Education, EDC, Providence, R.I.)

I. Program Description

Model III provides career counseling to those members of the population who are potential members of the labor force. Stated negatively, if an individual is actively engaged in work, seeking work, training for work, or under age 16, then that person is not a member of the target population, or market, for the services of this project. One objective of the program is to encourage individuals to consider entering the labor force and to facilitate that entry by means short of providing placement and/or training services.

The second objective of the program is to accomplish the above through definite means. Specifically,

1. individuals are contacted and invited to participate through printed and broadcast advertising,

2. counseling services are to be provided through scheduled telephone sessions and

3. the telphone counselors are to be paraprofessionals.

The process will be described briefly. Individuals are contacted through advertisements which solicit their interest in career counseling and request that they phone the program to receive services. Upon calling, the respondent is given an initial interview (over the phone) which collects basic information for the purpose of introduction, screening, conducting advertising research, and scheduling into the program. A phone call between a counselor and the respondent is scheduled for the third following working day. From that point, additional contacts are scheduled between the respondent and the counselor. The period between sessions is used by the counselor and/or the respondent to accomplish tasks necessary for the career guidance procedure to progress. The counselor may need to obtain additional information (e.g., finance sources, training agencies), or the respondent may be assigned the task of reading career materials in a given area, of contacting other agencies offering training, placement, or other career related services in the community. The process continues until the respondent (1) enrolls in a preparation program, (2) concludes no preparation is appropriate and initiates job search, (3) terminates on his own and states why, or (4) becomes impossible to contact further. Respondents who either enroll in training, (1), or initiate a job search, (2), are contacted after two weeks and then again after two more weeks in order to check on progress; this is follow-up activity. This process is elaborated in Chart I, Model III Organization and Process. In the chart Ⓒ indicates client movement, Ⓜ indicates materials movement and Ⓔ indicates external resources movement.

One can see that the primary point of direct contact between the client and the program is the counselor. This direct contact is supported by (1) a resource center consisting of career materials for reference of the counselor, other staff, and very infrequently by respondents, (2) an information unit whose task is to produce readily usable materials for counselor use, (3) an outreach unit whose function is to create the advertising messages which bring the potential training and placement agencies and promotes diffusion of the Model III career education program itself, and (5) an administrative unit. Also present, due largely to research and development requirements rather than to operational requirements, is a research unit and a set of consultants. Thus the program is organized into the following units:

a. Outreach Component
b. Counseling Component
c. Information Unit
d. Resource Center
e. Institutional Development
f. Research Component
g. Management

II. Description of Accounting System

The EDC general accounting system collects and provides cost data on the basis of the above components. The project supplements that information by collecting cost data according to subcomponents. For example, the counseling component contains the following subcomponents:

a. On-phone, home based,
b. Off-phone, home based,
c. Training (of staff),

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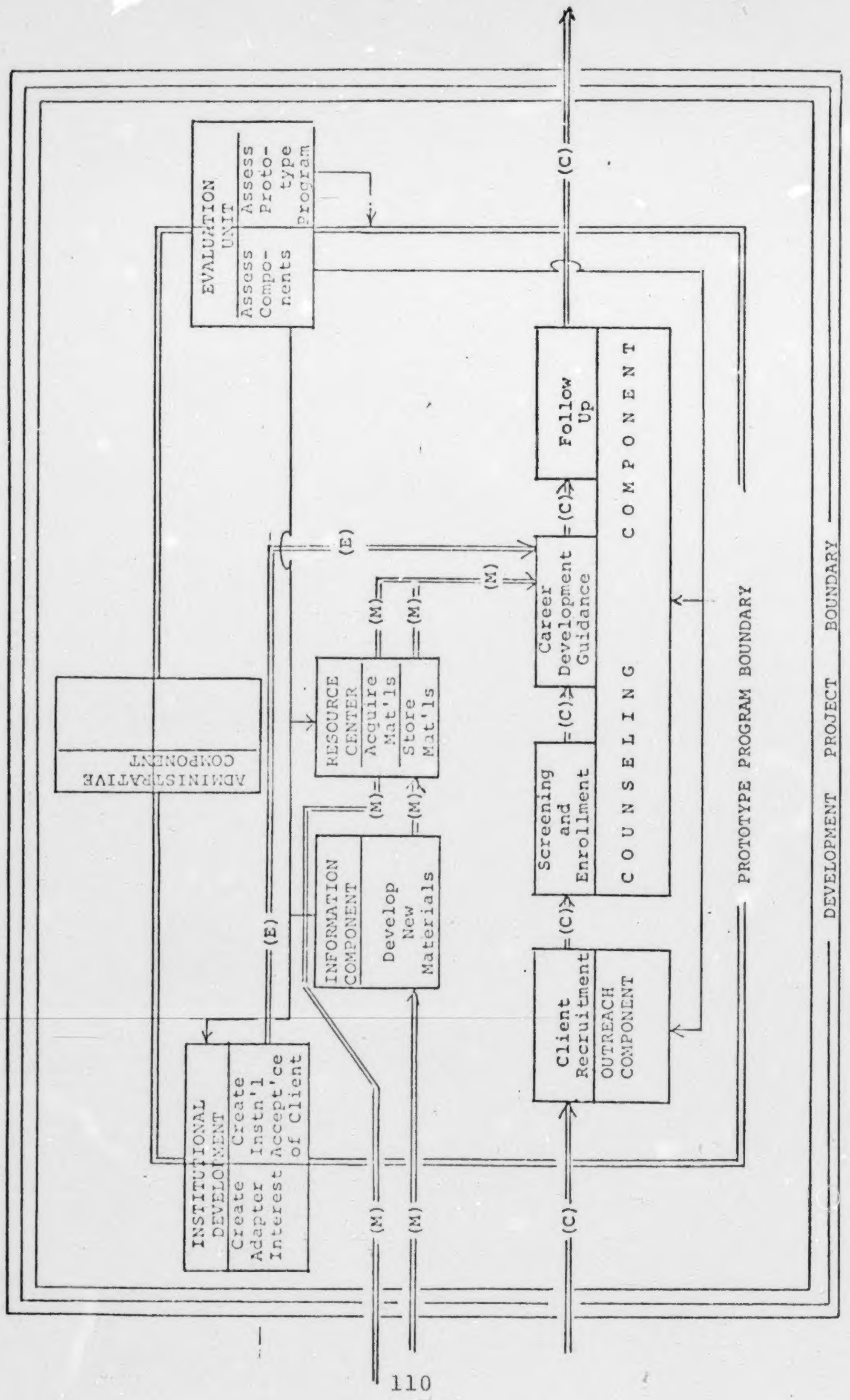
Chart I

Model III: Organization, Services, and Process


EVALUATION UNIT
Assess Components
Assess Prototype Program
INSTITUTIONAL DEVELOPMENT
Create Adapter Interest
Create Instn'l Accept'ce of Client
ADMINISTRATIVE COMPONENT
INFORMATION COMPONENT
Develop New Materials
RESOURCE CENTER
Acquire Mat'ls
Store Mat'ls
Client Recruitment
OUTREACH COMPONENT
Screening and Enrollment
Career Development Guidance
Follow Up
COUNSELING COMPONENT
PROTOTYPE PROGRAM BOUNDARY
DEVELOPMENT PROJECT BOUNDARY
(C)
(M)
(E)

d. On and off-phone, non-home based,
e. Supervision
f. Other
g. Vacation
h. Holiday
i. Sick

The components and their subcomponents are indicated by Charts II-VII. How are various costs treated with respect to these categories?

Personnel Resource Allocation and Cost: All staff fill out the time sheets displayed in Charts II-VII.[1] Reporting is to occur daily with reports submitted weekly. All staff report total hours broken down into subcomponent categories to the nearest half hour. Hourly paid staff, however, must complete the report so that the number of hours sum to a given total. The records at EDC-Career Education retain the time allocation to component and subcomponent.

Dollar value is assigned to the physical allocations of time through an effective wage rate (equal to salary divided by total hours for salaried staff and through the actual hourly pay rate for non-salaried staff.) Vacation and sick leave time is accrued at a given rate and assigned proportionately to the distribution of total time.

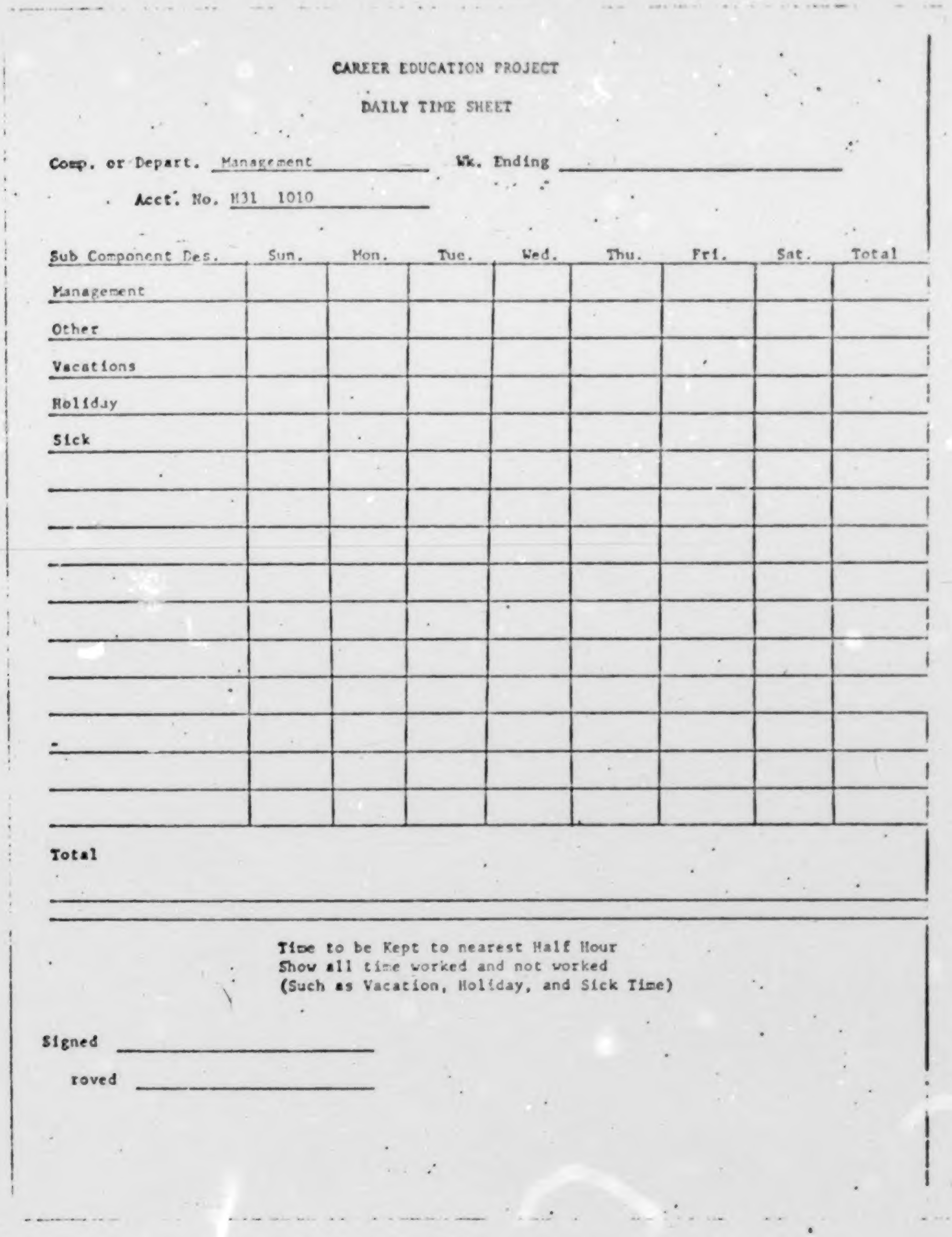
Consultants charges are assigned to the component and sub-component to which their work relates.

Most non-personnel resource allocations and costs are assigned to the administrative component. This is true for rent and maintenance, utilities, all telephone, except counseling which has its own system, and any equipment charges. Transportation of Persons and Per Diem is charged to the component and subcomponent to which the associated staff time is charged.

---

1. There is no time sheet for the Information Component. This component was, however, in the process of being established (pulled out of Resource Center) at the time of ARIES' visit and a sheet for this component presumably exists at present.

Chart II



CAREER EDUCATION PROJECT

DAILY TIME SHEET

Comp. or Depart. Management Wk. Ending ____________

Acct. No. H31 1010

Sub Component Des.	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Total
Management								
Other								
Vacations								
Holiday								
Sick								
Total								

Time to be Kept to nearest Half Hour
Show all time worked and not worked
(Such as Vacation, Holiday, and Sick Time)

Signed ____________

roved ____________

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Chart III

CAREER EDUCATION PROJECT

DAILY TIME SHEET

Comp. or Depart. Research **Wk. Ending** ________________

Acct. No. H31 1020

Sub Component Des.	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Total
Formative Evaluation Outreach								
Formative Evaluation Counseling								
Formative Evaluation Resource Center								
Formative Evaluation Audio-Visual								
Formative Evaluation Print								
Summative Evaluation								
Supervision								
Other								
Vacations								
Holiday								
Sick								

Total ________________

Time to be Kept to nearest Half Hour
Show all time worked and not worked
(Such as Vacation, Holiday, and Sick Time)

Signed ________________

pproved ________________

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Chart IV

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CAREER EDUCATION PROJECT

DAILY TIME SHEET

Comp. or Depart. Outreach Wk. Ending

Acct. No. H31 1030

Sub Component Des.	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Total
Radio								
T.V.								
Press								
Telephone Canvassing								
Other								
Vacations								
Holiday								
Sick								

Total

Time to be Kept to nearest Half Hour
Show all time worked and not worked
(Such as Vacation, Holiday, and Sick Time)

Signed

roved

Chart V

CAREER EDUCATION PROJECT

DAILY TIME SHEET

Comp. or Depart. Counseling **Wk. Ending** ____________________

Acct. No. H31 1060

Sub Component Des.	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Total
On-Phone Home-Based								
Off-Phone Home-Based								
Training (for trainor - Trainees includes gen. research)								
On & Off-Phone Non-Home Based								
Supervision								
Other								
Vacations								
Holiday								
Sick								

Total

Time to be Kept to nearest Half Hour
Show all time worked and not worked
(Such as Vacation, Holiday, and Sick Time)

Signed ____________________

Approved ____________________

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Chart VI

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CAREER EDUCATION PROJECT

DAILY TIME SHEET

Comp. or Depart. Resource Center **Wk. Ending** ____________

Acct. No. H31 1070

Sub Component Des.	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Total
Reception Services for HB								
Reception Services for NHB								
Search & Aquisitions								
Services for Counseling personnel								
Dev. of Info Unit Modules								
Services for other Project personnel								
Supervision								
Other								
Vacations								
Holiday								
Sick								
Total								

Time to be Kept to nearest Half Hour
Show all time worked and not worked
(Such as Vacation, Holiday, and Sick Time)

Signed ____________

Approved ____________

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Chart VII

CAREER EDUCATION PROJECT

DAILY TIME SHEET

Comp. or Depart. Institional Development Wk. Ending ____________________

Acct. No. H31 1080

Sub Component Des.	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Total
Institutional Development								
Other								
Vacations								
Holiday								
Sick								
Total								

Time to be Kept to nearest Half Hour
Show all time worked and not worked
(Such as Vacation, Holiday, and Sick Time)

Signed ____________________

proved ____________________

III. Assessment of the System

As a preface to this section, it should be noted that EDC is continuing to develop and improve its accounting system. The above description and the remarks which follow are based on the system as it was in late October, 1973. Modifications are presently underway.

The cost categories do not lend themselves neatly to describing research and development costs to NIE. There is little that can be associated with the activity categories of Chapter Three. The only exception is the research component and allocations made to it from consultant costs. Here the assumption must be made that no non-evaluation activities are performed by staff in that unit. It is similarly not clear how the activities of the remaining components relate to evaluation and the other activities in Chapter Three. It would be possible to make appropriate allocations based on judgmental assessment of the primary thrust of subcomponent tasks. For example, it is tempting to classify the activity of the information unit as "Design" and that of the counseling unit as "Application". The application of the categories of Chapter Three and the matrices of Chapter Four would at least encourage an effort to allocate component tasks among research and development activities (e.g., the institutional development unit performs some duties which relate to "application" and others which relate to "diffusion".[1]

The primary concern of EDC has been with recording activity, resource allocations, and cost for the purpose of assisting potential adopters. The components and subcomponents have been designed with that in mind. One can see the relationship as described in Chart 1.

---

[1] We do not wish to imply expert knowledge in this regard. To verify these relations would require an intensity of analysis that goes beyond this study. We do feel that the relationship as shown are generally true and are those implied by the component structure given by EDC.

This chart displays both the component units, other than consultants which have been assigned to those components that are displayed, and the services rendered by the respective component as understood by ARIES.[1] While the subcomponents used by EDC do not fully fit those implied by Chart I, one can see that EDC categories are already structured along the line of those required for estimation of service delivery costs. The time reporting documents are tailored for the general assignments of staff in each component. When a person in one component area works for the benefit of another component area, he charges the second component area directly, logging his time according to the appropriate subcomponent of that component. The form make provision for "other" activity to record time in general meetings and other non-specified activities. Also, since the system retains the physical allocation of personnel resources, EDC is well along the way to being able to specify physical requirements in the way of staff person hours, space, equipment and facilities to operate a given activity.

The nature of EDC operations means that client data exists. That is, the number of clients in the program at any time, the number who enter and leave, the length of stay and number of "treatments" (or phone sessions) can be made available. Since estimates of adopter resource and cost requirements start with the operational level (client load) or output goals (number of clients who enter training or job search), the elements of service delivery cost are there.

Only two weaknesses remain. First, almost all non-personnel requirements (e.g., rent, utilities, non-counseling phone) are assigned to administration. It is not possible at present to assign them to components. However, doing so in the future involves only (a) direct measurement where possible (e.g., square foot assignment to each component and/or (b) proration based on the most sensible burden rate. Also, it is not clear that physical units are retained, although since purchase orders and bills for service exist, one may hope

---

1. EDC indicates it would be possible to assign direct activity cost codes per ARIES design (i.e., product design, etc.) to each EDC component (unit) to generate the desired data. The Project is completing a cost study for NIE which uses somewhat similar designations for costs since May, 1972.

that assignments can be made on the basis of physical quantities. However, EDC is aware of this and is moving to track and allocate divisable resources, such as space, and to allocate indivisible resources, such as administrative service.

The second weakness is the absence of research and development activities, as noted. Recall that in Chapter Four, Section I we recommended that estimation be based on upper and lower limits. Therefore estimation on that basis could not be made unless the EDC components were also cost coded as mentioned above.

Chapter Seven

DESCRIPTION AND ASSESSMENT OF MODEL IV INFORMATION SYSTEM

(Residential, Family Based Career Education Program,
MPEEDC, Glasgow, Mont.)

I. Program Description

Model IV provides career education services to residents of the six state area of Montana, Nebraska, Wyoming, North Dakota, South Dakota, and Idaho who are under or unemployed and roughly at povery level incomes. These are general criteria, and Mountain Plains imposes other criteria as well. If these are met, the family unit is accepted.

Model IV is residence based -- the families are moved to Glasgow Air Force Base -- and, in principle, family focused. Services are provided to the entire family as well as to the member(s) of the family undergoing training. In one program Mountain Plains offers services which are available separately and disjointedly under existing programs such as AFDC, WIN, MDTA, etc.

The objective at Model IV is to raise the employment level in terms of income, potential for job advancement, and personal development of the family. Success means placement in employment with some expectation of permanence or placement in advanced training.

Since Mountain Plains provides, in a unified system and in a residential setting, those services which other programs provide separately,[1] it is at one time the most traditional (that is, it is a training program with employment objectives) and most complex of the career education projects (that is, in the breadth of services). It is possible to provide a list which categorizes the services offered by Mountain Plains.

---

1. This separation is both institutional and geographic.

Chart I

Mountain Plains Component Services

A. Community Services

Medical, Dental, Education, Day Care, Housing, Recreation

B. Family Services

Personal Counseling, Home Management Skills, etc.

C. Individual Services

Personal Counseling, Employment Counseling, Training (Occupational Preparation), Job Seeking and Retention Skills, Placement

D. Support Services

Administrative; Recruitment, Screening, and Selection; Follow-up

We will briefly sketch the process. Potential students are *recruited* through selection offices located in the several states. If the family meets Mountain Plains requirements, they are accepted. The family then moves to Mountain Plains, where a community instructor is assigned and a brief period of time is allowed for the family to *move in and adjust*. Following that, a short *orientation* takes place, which familiarizes the family life with the program, collects initial information through testing and interview, and fulfills logistical requirements. After orientation, all adult members of the program participate in a four week *core curriculum* and begin mandatory *counseling* and *career guidance*. The core curriculum emphasizes home skills (e.g., budget management, credit, house care). Counseling has responsibility for personal (e.g. self esteem) and non-employment interpersonal (e.g., marital relations) problems. Problems related to career choice, training, employment, and placement are the province of career guidance. Upon completion of the core curriculum, the head of household is to be sufficiently along in career development so that *occupational preparation* can begin. This activity may commence at or beyond the point of developing those basic skills which are necessary for successful employment.

The other adult member of the household must make a decision at the completion of the core curriculum.

The three options open to this person are (1) to enroll in occupational preparation, (2) to enroll in homemaker (production) program, (3) to enroll in no further programs.

Also at the completion of the core curriculum, both adult family members continue in counseling.

As their training nears completion, students in occupational preparation enter a work experience component which is actual employment in the area of training. The purpose is to evaluate the effect of the student development services received up to this point.

Near the completion of training and work experience, the person participates in placement skills development and actual placement efforts on his or her behalf begin. After the student is placed, follow-up and follow-through services are maintained and, in principle, families may continue to receive some services to aid them in adjustment to their new environment. If the placement proves unsatisfactory, additional placement efforts are provided.

The process is illustrated in Chart II. It must be remembered that the entire family is present at Mountain Plains and that normal personal and community services (e.g., health, dental, education and child care, and recreational) are being provided throughout the process described above.

Mountain Plains organizational units are described in the following outline.

A. Governance

1. Board of Directors

B. Administration

1. Director, Assistant Director, and Controller

2. Administrative Services

a. Personnel
b. Facilities, Property, and Purchasing
c. Reprographic Services

C. Education Services

1. Foundation Education

2. Occupational Preparation

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Chart II

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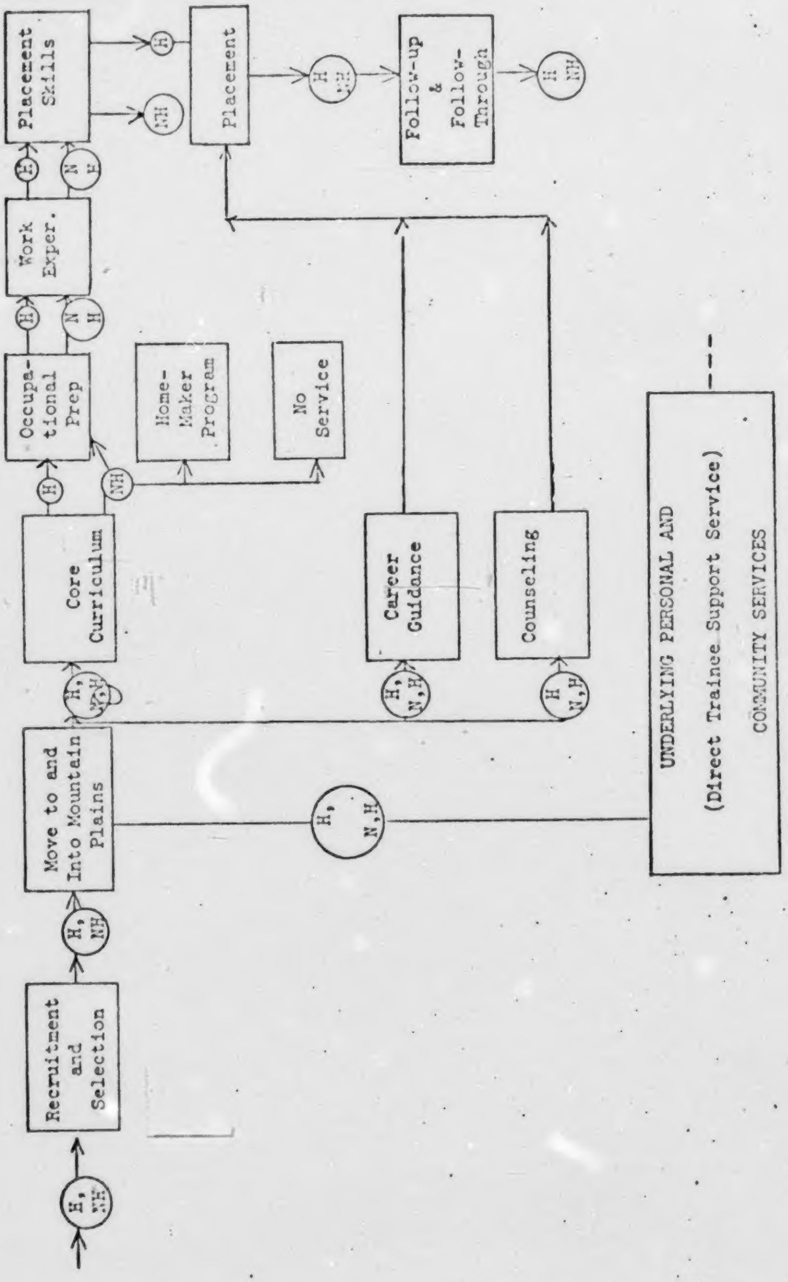
Essential Elements in Flow of Mountain Plains Services to Clients

{Head of Household Indicated by (H); Non-head Adult in Household by (NH) Entire Family (N NH)}



H, NH
Recruitment and Selection
H, NH
Move to and Into Mountain Plains
H, N, H
Core Curriculum
H
NH
Occupational Prep
Home-Maker Program
No Service
H
N H
Work Exper.
H
N H
Placement Skills
H
NH
Placement
H NH
Follow-up & Follow-Through
H NH
H, N, H
Career Guidance
H N, H
Counseling
H, N, H
UNDERLYING PERSONAL AND (Direct Trainee Support Service) COMMUNITY SERVICES

D. Support and Field Services

1. Placements
2. State Offices
3. Child Development
4. Counseling Services
5. Career Guidance

E. Research Services

Unlike Model III organizational groupings, staff in many of these areas participate in more than one of the component services shown in Chart II. For example, career guidance staff are associated with clients in the orientation, occupational preparation, work experience, placement skills and placement components of the program.

II. Description of the Accounting System

A. Reporting Categories

The Mountain Plains system begins with the line item categories as shown on Chart III. Mountain Plains then makes explicit provision for the allocation of line item costs to research and development and operations. Their definitions are as shown in Chart IV. Thirdly, eleven functions are defined by Mountain Plains. These are:

1. Instruction
2. Administration
3. Counseling and Community Development
4. Career Guidance
5. Child and Parent Development
6. Recruitment
7. Placement
8. Sick Leave Paid
9. Vacation Paid
10. Holiday Paid
11. Approved Unpaid Leave

Chart III

MOUNTAIN-PLAINS EDUCATIONAL AND
ECONOMIC DEVELOPMENT PROGRAM

CHART OF ACCOUNTS - LINE/TYPE EXPENSES

TITLE	NEW#	OLD#
SALARIES AND BURDENS:		
Salaries	01	04,05,06,08,09
Sick and Emergency Leave	08	20
Paid Vacation	09	22
Paid Holiday	10	21
F.I.C.A.	14	41
Morale and Welfare	15	42
Retirement	16	43
Workmen's Compensation	17	44
Unemployment	18	45
Medical-Life Insurance	19	46
TOTAL Salaries and Burdens		
TRAINEE ALLOTMENTS:		
Trainee Allotment	21	31
Early Childhood Assistance	22	33
FACILITIES		
Rearrangement Cost	31	53
Building and Ground Maintenance	32	54
Utilities	33	55

Chart III
(Cont.)

TITLE	NEW#	OLD#
FACILITIES CONTINUED:		
Rental	34	56
Joint Usage	35	57
TOTAL Facilities		
INSTRUCTIONAL SUPPLIES AND MATERIALS:		
Instructional Supplies	37	61
Instructional Publications and Printing	38	62
Other	39	63
TOTAL Instructional Supplies and Maintenance		
EQUIPMENT:		
Trainee Equipment	41	71
Staff Equipment	42	72
Equipment Rental	43	121
Equipment Maintenance	44	122
TOTAL Equipment Costs		
SUB-CONTRACTS AND PROFESSIONAL FEES:		
Consultants	46	81
Data Services	47	82
Other Sub-Contracts	48	83
Outreach	49	88
TOTAL Sub-Contracts and Professional Fees		
TRAVEL:		
Airplane	51	91

Chart III
(Cont.)

TITLE	NEW#	OLD#
TRAVEL CONTINUED:		
Auto	52	92
Per Diem	53	93
Other	54	94
TOTAL Travel		
VEHICLE EXPENSE:		
Vehicle Rental	56	101
Vehicle Operation Expense	57	102
TOTAL VEHICLE COSTS		
RELOCATION:		111
SUPPLIES AND MATERIALS:		
Office	61	131
Postage	62	132
Reproduction	63	133
Other	64	134
TOTAL Supplies and Materials		
TELEPHONE AND TELEGRAPH:	66	141
MAGAZINE AND SUBSCRIPTIONS:	71	151
CONFERENCE AND MEMBERSHIPS:	74	161
FREIGHT:	77	171

Chart III
(Cont.)

TITLE	NEW#	OLD#
INSURANCE AND MEDICAL COSTS:		
Insurance	81	181
Participant Medical Costs	82	182
TOTAL Insurance and Medical Costs		
TAXES AND LICENSES:	85	191
INVENTORY ADJUSTMENT:	88	201
RECRUITMENT:	91	210

CHART IV

Mountain Plains Definitions

Operations:

Those activities which would be necessary to continue the operation of the Model IV program in a fully developed, stable mode. This includes pre-testing and post-testing for purposes of diagnosis and validation. It includes preparation for regular participant related activities, the activities themselves, and other directly related paperwork such as scoring tests and reporting participant progress.

R & D:

Those activities necessary to develop, stabilize, and test the Model IV program. This includes the definition, design, creation, and redesign of program objectives; the development of programs and materials including curriculum; and the development of procedures. Also included is the design of evaluation; the collection of data for research purposes; the preparation of formative evaluation reports and responses to these reports; and all documentation of the plans, discoveries, progress and products of the program.

Administration:

Management of operations and R & D efforts. This function is performed by state office staff, senior instructors and other supervisors. It includes community relations, procedural administration and reporting, the supervision of staff, the projection of resource needs, the provision of resources, decision making to support these processes, and exploration and communication in support of these processes.

Administration Related to Operations: Administration of those activities which would be necessary to continue the operation of the Model IV program in a fully developed, stable mode.

Administration Related to R & D: Administration of those activities necessary to develop, stabilize, and test the Model IV program.

Finally, a large number of cost centers are defined. These are displayed in Chart V.

We have then three dimensions of resource and cost allocation: (1) Line Items, (2) Research and Development/Operations, and (3) Treatment Services. We shall want to describe the methods by which the values of resources and costs in the line item dimension are transformed into the other two dimensions. The method for so doing is based on either a measurement and recording system (direct allocation) or a system of arbitrary proration (indirect allocation). We now turn to a description of the direct reporting system.

B. Cost Reporting at Mountain Plains Staff Time (and Cost) Reporting System

The heart of the resources and cost system is, as was stated in Chapter Three, the time reporting system. This is so since it is from personnel time reports that personnel gross salaries are computed and it is on the basis of either personnel time or the associated gross salaries that most indirect allocations are made.

At Mountain Plains, staff report their time in terms of actual hours worked. Activity is reported daily and time sheets are submitted on a bimonthly basis. Chart VI is illustrative. The four hour entry displayed indicates a charge to cost center 127, or drafting on the 8th of the month. The "1" entered under the R & D column indicates that activity was employed in the research and/or development and that the function was that of instruction. Staff may charge to any cost center and function based on the content of their activity.

Those individuals who are executive officers or who are employed in either the controller's office or administrative services report their time as O/H (overhead) unless they make a recurring, large, allocation to some one of the eleven functions.

Non Personnel Reporting. Materials, supplies and equipment are recorded in a manner which assigns them ultimately to a cost center in terms of both physical quantity and cost. Chart VII shows the recording document used at Mountain Plains.

Non Staff Services Reporting. Allocations of service and cost are assigned directly to the using cost center. It must be possible to provide physical units based on billing invoices submitted to Mountain Plains.

Chart V

MOUNTAIN-PLAINS EDUCATION & ECONOMIC DEVELOPMENT PROGRAM, INC.

COST CENTERS

ADMINISTRATIVE OVERHEAD

TITLE	NEW#	OLD#
EXECUTIVE DIVISION:		
Executive Staff	101	7510
Board of Directors	102	
Controller-Accounting	105	7550
Data Center	106	7550
ADMINISTRATIVE SERVICES:		
Division Support	111	7610
Personnel Services	112	7630
Property Control & Purchasing	113	7640
Facilities & Maintenance	114	7670
Reprographics Services	115	7650
Multi-Media	116	7650
Program Support	117	7680

Chart V
(Cont.)

TITLE	NEW#	OLD#
EDUCATION SERVICES:		
Division Support	120	4110
Occupational Preparation-Department Support	121	4130
Building and Trades	122	4410
House Fund	123	
Plumbing, Heating, Sheet Metal, Refrigeration	124	
Building Construction & Maintenance	125	
Electronics-Electricity	126	
Drafting	127	
Automotive and Small Engines	128	4150
Support Welding	129	
Automotive	130	
Small Engines	131	
Office Education	132	4420
Marketing and Distribution	133	
Food & Lodging	134	4140, 4141
Guest House	135	
Lodging Program	136	
Food Services	137	
Social And Educational Services	138	4440
Foundation Education-Department Support	141	
Math Skills	142	4510, 4520
Communication Skills	143	4540
Home Skills Education	144	5205
Health Education	145	5303

Chart V
(Cont.)

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TITLE	NEW#	OLD#
SUPPORT SERVICES (GLASGOW)		
Division Support	151	7810
Career Guidance	152	4740
Career Development	153	4740
Work Experience	154	4750
Counseling	155	5005
Personal Counseling	156	5005
Community Instruction	157	5005
Community Recreation	158	5105
Child Development	159	
Infant Day Care	160	5410
Nursery Program	161	5420
Kindergarten	162	5430
Parent Effectiveness	163	
SUPPORT SERVICES (SIX STATE):		
Montana	171	7820
North Dakota	172	7830
South Dakota	173	7840
Nebraska	174	7850
Wyoming	175	7860
Idaho	176	7870
RESEARCH SERVICES:		
Division Support	181	8510
Systems Level Research	182	8520
Intra-Program Research	183	8530
Curriculum	184	8560
DIRECT TRAINEE:	190	7010
SERVICE STATION	200	8720

Chart VI

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NAME ____________

EMPLOYEE NUMBER ____________

Period from __________ to __________

Cost Centers	1/16	2/17	3/18	4/19	5/20	6/21	7/22	8/23	9/24	10/25	11/26	12/27	13/28	14/29	15/31	Oper	R&D	O/H	Sick	Vac	Hol
127																					
127								4									1				

Employee Signature ____________

Supervisor Signature ____________

Non-Comp Time ________

Chart VII

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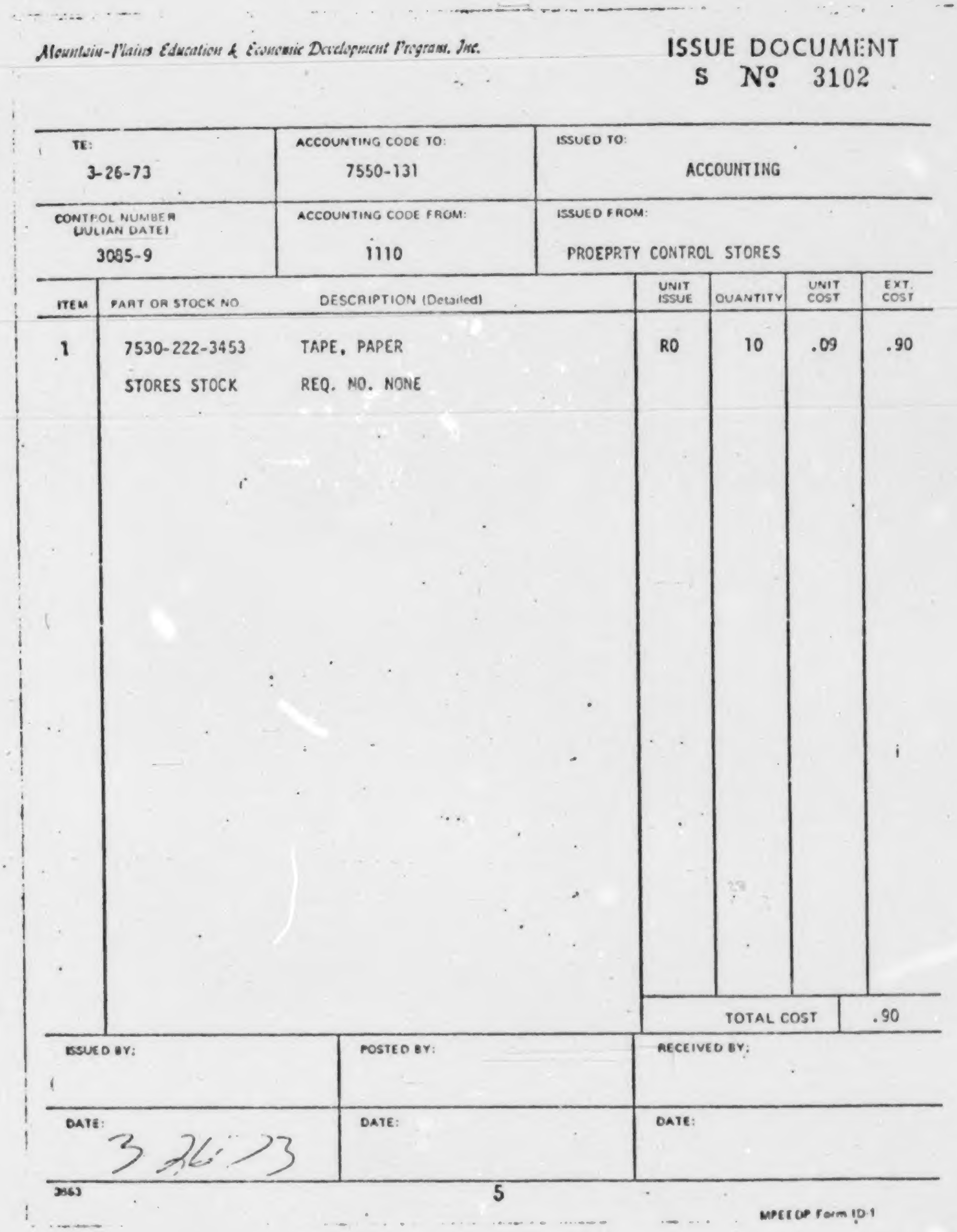

Mountain-Plains Education & Economic Development Program, Inc.

ISSUE DOCUMENT
S Nº 3102

TE: 3-26-73	ACCOUNTING CODE TO: 7550-131	ISSUED TO: ACCOUNTING
CONTROL NUMBER (JULIAN DATE) 3085-9	ACCOUNTING CODE FROM: 1110	ISSUED FROM: PROEPRTY CONTROL STORES

ITEM	PART OR STOCK NO.	DESCRIPTION (Detailed)	UNIT ISSUE	QUANTITY	UNIT COST	EXT. COST
1	7530-222-3453	TAPE, PAPER	RO	10	.09	.90
	STORES STOCK	REQ. NO. NONE				
			TOTAL COST			.90

ISSUED BY:	POSTED BY:	RECEIVED BY:
DATE: 3 26 73	DATE:	DATE:

3863

5

MPEEDP Form ID-1

Student Time Reporting at Mountain Plains. Mountain Plains also records the input of student time into various categories of activity. The allocation is part of the time card displayed in Chart VIII.

The specification of the activities which will comprise the terms of report is undergoing refinement at the time of this report. The terms are developing along the same lines as specification of the service elements of the production processes as displayed in Chart I, or their subelements.

C. Assignment of Line Item Resources and Costs to Function, to Research and Development and Operations Activities, and Service Elements

In this section we give a summary description of the allocation of various line item resources and costs into other dimensions. We shall take the items in groupings according to similarity of their character and method of assignment. For each of these we will discuss the flow of assignment from line item to cost center to research and development or operations activities and functions. Subsequently we will describe the assignment flow to program service elements.

Group A

(*Staff Salaries and Time*) Through time reporting, staff services and time are assigned *directly* to cost centers (See Chart VI). Based on time and known salary, an effective wage is computed and is the mechanism for assigning cost. The assignment from cost centers to functions and to research and development or operations is *direct* for all cost centers other than those of the executive division, the administrative services division, and direct trainee (services). The assignment of time to the cost centers of the executive and administrative services division is primarily that of overhead and is assigned *indirectly* to the functions and to the research and development and operations activities on the basis of the following ratio:

$$R_{ijk} = \frac{\text{Total gross salaries allocated to the } i^{th} \text{ cost center, the } j^{th} \text{ function, and the } k^{th} \text{ research and development or operation activity for all L staff members}}{\text{Total of All Gross Salaries Exclusive of those paid to Executive and Administrative Divisions}},$$

$$R_{ijk} = \frac{\sum_{l=1}^{n} (W_{ijkl})\ (t_{ijkl})}{\sum_{l=1}^{n} \sum_{K=1}^{2} \sum_{j=1}^{11} \sum_{i=120}^{200} (W_{ijkl})\ (t_{ijkl})},$$

$$\frac{S_{ijk}}{S_T}.$$

where w indicates the effective wage and t indicates the time allocation.

Letting $(O/H)^s$ indicate the dollar salary charges to overhead (or $(O/H)_m$ the disaggregated physical elements of those charges) then the assignment of $(O/H)^s$ to the respective combination of cost center, function, and research and development or operations, $(OH_{ijk})^s$, is given by

$$OH_{ijk} = (R_{ijk}) \quad (OH)^s$$

This ratio, R_{ijk}, is frequently used as the basis whereupon direct charges are assigned.

GROUP B

(Sick and Emergency Leave, Paid Vacation, Paid Holiday, F.I.C.A., and Retirement). These are determined on an accrual basis for each individual. Then they are allocated to cost centers, functions, and research and development or operations activities in the same proportion that time reported to each of such categories is of total time.

GROUP C

(Morale and Welfare, Unemployment, and Medical-Life Insurance). These are assigned directly to Administrative Services as O/H and assigned indirectly to other divisions on the basis of R_{ijk}.

Chart VIII

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TIME CARD
(Weekly Schedule)

Participant Name: ______________________

Clock Number: __________ Week Ending __________

GROUP I
2ND WEEK AFTER ORIENTATION

DATE STARTED:

		ATTENDANCE							INSTRUCTOR'S WEEKLY REPORT			
Hours	Learning Areas	M	T	W	Th	F	Instructor's Initial by Valid.	Comp.	Completed Course No.	Completed Unit No.	Started Course No.	Started Unit No.
A 8-9	46 CAREER GUIDANCE BLDG 810-2ND FLOOR											
B 9-10	46 CAREER GUIDANCE BLDG 810-2ND FLOOR											
C 10-11	11 MATH SKILLS BLDG 814-3RD FLOOR											
D 11-12	15 COMM. SKILLS BLDG 814-2ND FLOOR											
E 1-2	51 HEALTH BLDG 810-1ST FLOOR											
F 2-3	51 HEALTH BLDG 310-1ST FLOOR											
G 3-4	11 MATH SKILLS BLDG 814-3RD FLOOR											
H 4-5												

Special payroll explanations: ______________________

OCCUPATIONAL PREPARATION AREAS: Please indicate if student is within 90 days of validation in your area: ______________________

GROUP D

(Trainee Allotments and Early Childhood Assistance). These are assigned to Direct Trainee Services. These are not assigned further to functions and research and development or operations activities. Trainee allotments are paid on the basis of student time card reports of participation.

GROUP E

(Facilities). These items may refer either to resources and costs associated with student housing and support services or to Mountain Plains administrative, training, treatment facilities. Resources and costs associated with housing, etc., are assigned directly to Cost Center 190, Direct Student Services and not further. Resources and costs not so assigned are assigned as O/H directly to Administrative Services and indirectly to research and development or operations and to functions on the basis of R_{ijk}.

GROUP F

(Instructional Supplies and Materials; Trainee Equipment). This is assigned directly to the using cost center. If that is Direct Trainee Services, no further allocation is made. If any other cost center, it is assigned to research and development or operations activities or to functions based on the ratio R^*_{ijk} which has the same interpretation as R_{ijk} except that the summation is restricted to totals within the cost center.

GROUP G

(Staff Equipment). This is assigned directly to the using cost center. For that assigned to Executive and Administrative Services, the assignment to research and development or operations will be based on R_{ijk}. Within other cost centers the assignment is based on R^*_{ijk}.

GROUP H

(Equipment Rental, Equipment Maintenance). See Group C.

GROUP I

(Subcontracts and Professional Fees; Travel). See Group G.

GROUP J

(Vehicle Expense: Location). Expenses in this category are assigned directly to O/H through Administrative Services or to Direct Trainee Services (190). If 190, no further assignment is made. If the direct assignment is to Administrative Services, the further assignment is indirect and based on R_{ijk}.

GROUP K

(Supplies and Materials). Charges to this object area are assigned directly to Administrative Services. Further allocation is made on the basis of R_{ijk}.

GROUP L

(Telephone and Telegraph). For long distance, logs are maintained and cost is charged directly to the cost center. Further assignments to functions and to research and development or operations are also direct. General services are transformed into a charge per phone and assigned to the cost centers. Further allocation is identical to Group G.

GROUP M

(Magazines and Subscriptions, Conference and Membership, Freight, Insurance and Medical Costs, Taxes and Licenses, Inventory Adjustment, and Recruitment). See Group J.

Assignment to Program Services

Mountain Plains is interested in assigning costs to program services (e.g., see Chart I). Present plans are to do so on the basis of student time allocations as reported in their time cards (Chart VIII).

Let A = Total Staff Dollars
Let B = Total Staff Dollars to R & D
Then $C = A - B$
= Total Staff Dollars to Operations.

Let D_i = Total student hours in each component

$$\text{Then } D = \sum_{i=1} D_i$$

= Total student hours in all components.

The allocation of staff dollars to each of the I programs services is given by,

$$S_i^s = \left(\frac{D_i}{D}\right) C.$$

other costs (non-personnel) follow since they are based on gross salary dollars with the exception of Direct Trainee Services, for which allocation to individual services is inappropriate.

III. Assessment of Mountain Plains Cost Accounting System

A. Categories

Research and Development. Mountain Plains makes explicit provision for classification of activity and cost into research and development and operations. Administration has three classifications, two explicit and one implied: research and development, operations, and general.

The basic point to be made about the distinction between research and development and operations is that it depends upon staff member perception. When reporting, the individual must decide whether or not the activity "would be necessary in order to continue the operation of Model IV in a fully developed, stable mode." In many instances, this is *not likely to be known*. One must speculate as to what *would* happen rather than report what is being done at the time. In our opinion this may lead to frustration when staff take the report seriously, to capricious reporting should they not, and to the development of arbitrary administrative rules for classification in reaction. Where there is an organizational objective associated with cost reports (e.g., minimizing operational cost per student), administrative rules may be made to produce the desired result (e.g., when in doubt, charge to research and development). As has been stated previously (Chapter Three), we believe that people should report what they are *doing* in terms of purposeful activity. That is something they can assess.

Secondly, we believe that the categories are excessively broad. In viewing the progress of a research and development program, we believe NIE will want to know the degree to which activity is moving from design into application and thence to evaluation.

When cross classified with work units, the categories we have specified describe progress in the design, application, and evaluation of that unit. Further, administrative activity is not inconsequential, and we believe that the several overhead categories in our classification system provide a useful breakdown of administrative cost information. Further, vendor negotiations and liaison with the fundor (NIE) require substantial resource commitments and cost, especially during certain time periods, and it is in the best interest of NIE to analyze the degree to which that activity affects the performance of vendors.

Replication Categories. We believe that Mountain Plains is well along the way in issues related to cost estimates for potential adopters. This is especially so in the case of Education Service cost centers (See Chart V). These are categorized into kinds of training by occupational area or subject matter as appropriate.

We do not have a well-formulated list of services which describe the Mountain Plains process relative to adopter needs. However, we believe that their specificiation should focus on the results expected from each process in terms of effect on family. Chart II provides some direction. Its further refinement would be beneficial. However, even in its present state, we note that such services as (1) initial family adjustment, (2) orientation, (3) placement skills, and (4) follow-up and follow-through are client services which are not present in the current reporting system but which are distinct elements of the treatment process. (We are not fully satisfied with Chart II and do not wish to so indicate. For example, counseling and career guidance are not categories in terms of results but inputs. These categories should be analyzed accordingly. The question should be: Counseling -- To produce what result? Career Guidance -- To produce what result?)

Should such a classification of treatment services, or production departments be formulated, we believe that assignment of resource requirements and cost based on the proportion of total student time (student time records) allocated is not acceptable. To be so, one needs to assume constant ratios of student time to all other resources. Instead, direct records should be maintained.

This is not meant to criticize the reporting time of student time in activities. Mountain Plains maintains extensive records of student allocations. Then disaggregated ratios of resource requirements to students or student inputs could be formulated. This, as was shown in Chapter Four, is the basis for adopter information in a setting of changed levels of services in project operation.

B. Staff Time Reporting

The reporting system could be modified to handle the additional dimension imposed by service components (e.g., Chart II) classification. Time reports would substitute the service (or component) dimension for the date dimension (see Chart VI).

This would require that time reports are submitted on a daily basis.

This is not a loss but a gain. Not only would additional information be obtained, but contemporaneous reporting would be encouraged and reporting accuracy increased.

IV. SUMMARY

Mountain Plains has a system which separates the costs of research and development from operaions. However, we believe disaggregation into additional categories is necessary if the data is to be useful to NIE for purposes of monitoring research and development progress.

The category of operations is intended to provide estimates of cost at adopter sites. This is essentially our lower bound estimate. We believe that the classification of activity and cost into operations based on staff perception of the necessity of their continuation in a non-development setting is not wise. Either staff must perpetually speculate, or administrative rules are imposed.

Actual resource requirements, which can be priced at the adopter site, are more important in any case. We believe Mountain Plains retains these for staff time but that physical resources may be more difficult to reconstruct.

Also for replication purposes, the categories should be in terms of accomplishment of the goal related steps in the treatment process. These we call component services or task categories. These are not yet complete at Mountain Plains, but work is going forward. Resource allocations into these components should be direct.

Finally, Mountain Plains maintains records of student time allocations into the present categories which are approximate components, and will continue to do so when refinement of the component structure is accomplished. Such records will prove valuable in estimating resource requirements at changed levels of student enrollment.

Chapter Eight

ACCOMPLISHMENTS, CONCLUSIONS, AND RECOMMENDATIONS

This summary will be divided into three sections. These are (1) Accomplishments, (2) Findings, (3) Recommendations. They have been modified in light of a second investigation of NWREL during June of 1974.

I. Accomplishments

A. A structure for a record system which will report contractor program development costs to the fundor in terms of standard research and development activities and budgetary work units was designed.

B. A tentative structure of a record system from which estimation of adopter costs could be made was designed. A method of estimation based on that record system was suggested.

C. The accounting systems of the present career education program research and development contractors were compared with the systems referred to above.

D. The accounting systems of the present contractors were compared with one another to determine the potential for uniform reporting procedures.

E. An additional study of the cost system at Northwest Regional Educational Laboratory was completed over the period of June, 1974. March, 1974 costs were assigned to ARIES Standard Categories. Costs were assigned to ARIES Standard Categories. (See Appendix B.)

II. Conclusions

A. Considerable diversity exists among the resource allocation and expense recording and reporting systems of research and development contractors.

B. Contractors employ different conventions for allocation of some resources and expenses and for proration of indirect costs to their several categories —even when the categories themselves are similar among contractors.

C. Some contractors do not trace the cost of facilities and associated utilities and services to the program staff members who utilize them. Instead, these resources and costs are absorbed into general management or contractor indirect charges. Facility costs are therefore under reported and inaccurately apportioned.

D. Controllers of Model II contractors have indicated that they could, and would be willing to, provide uniform reports with respect to allocation and proration conventions even where this requires special calculations.

E. When contractors are grouped by the kind of career education model under development, Model II contractors provided very little operational cost detail but great detail under development, evaluation and other nonoperational activities. Model III provided very little detail with respect to the operational-developmental dichotomy of program development cost reporting but significant detail within operational activity. Model IV provided significant detail within both operational and nonoperational activities.

F. For no contractor does the recording and reporting system distinguish sufficiently between those expenditures of time and dollars on activities directly related to final development products(s) and those related to supporting and secondary tasks. This weakens the ability to eliminate the cost of those supporting and secondary tasks, which would not continue in adopter settings, when formulating cost estimates.

An important research and development activity that ARIES has designated is Fundor Negotiation and Liaison (FNL). At NWREL, staff are aware that this activity is performed. However, since no associated reporting category is provided, Fundor Negotiation and Liaison activity is spread among numerous other categories. Fortunately operational staff are separated from involvement with preparation of reports to NIE, a heavy contributor to FNL, and therefore applications, or operations, costs reporting distortion is reduced thereby. However, this is due to a very definite separation between development and operational staff which exists at NWREL. At developer sites where such a separation does not exist FNL activity may be included in application, or operational, costs. The result will be an upward bias.

G. For at least two of the six contractors, the resource requirements and costs associated with acquiring the capacity to deliver program services (acquisition costs) were not specifically recorded in the developmental setting. They are, therefore, lost. This is especially true with respect to allocations and costs of personnel. This will impede estimation of adopter acquisition costs.

H. For some models, some acquisition tasks continue in an operational setting. Therefore, the cost of acquisition for these tasks can be estimated by analysis of operational costs, assuming the operational cost record is sufficiently detailed by component services. Moreover, a record of results, or output, of acquisition services must be kept. We do not believe that detailed and results records are maintained at present.

I. Accuracy of adopter cost estimates will be promoted if the developed program is field tested in a location other than the development site, if a more detailed cost accounting system is introduced, and if cost estimates are based on the associated record of resource allocation. This is especially the case for program acquisition costs.

J. One problem in estimating service delivery cost is that the degree of program design and evaluation which occurs in an adopter setting is unknown.

Most contractors utilize a category of activity termed operations as distinct either from research and development in toto or from research and development component activities such as development and evaluation. This practice tends to produce a single estimate of adopter costs which assumes that neither program development (which we have termed Design) nor program evaluation takes place when the program is adopted.

K. The level of wages and prices, but especially staff wages and salaries, will differ between development contractors and program adopters and also among adopters in different regions and demographic settings. For purposes of estimating adopter costs, emphasis must be given to the physical quantities of resources required. Costs should be based on wages, salaries, and benefits likely to be paid in adopter institutions.

L. The program resource requirements which will require additional expenditures by adopters will differ between development contractors and adopters and also among adopters. This again underscores the specification of physical requirements for resources in addition to their cost.

M. The reporting of operational (we term these Application Activity) costs by several contractors does not detail operational costs in terms of program service components and student behavioral results. As a result, for these contractors, no estimates can be attempted when the composition of program in terms of its service components is changed from that at the time of measurement. Most contractors hope that their program will be structured at adopter sites in the same manner as at development sites. However, at NWREL, in June, it was apparent that adopters may desire to modify program structure. At that time the need for a more detailed description of operational activity becomes evident.

N. At NWREL, ARIES found that at least in some instances staff reported time for one activity to some other. This was explained as being due to a NIE requirement that staff may not report (or be billed) for activity other than that for which they were originally budgeted. (See Appendix B.)

O. Based on subsequent work at NWREL, rough estimates of annual per pupil costs ranged from $4254 to $1724. (See Appendix B.)

III. Recommendations

A. For future reporting of program development resources and costs, we recommend development of a system which does not, in itself, explicitly attempt to distinguish research and development activity as distinct from operational activity. We also recommend that all staff, developmental as well as operational, have accessibility to the same reporting categories.

B. The resource allocation and cost recording and reporting system should utilize two dimensions in addition to customary line item. The first should consist of a set of standard categories which describe the major activities to which resources are assigned in any development project.[1] The second dimension should consist of categories which describe the fundamental products of the development effort. The primary product(s), should be described in terms of their service components and general treatment results.[2] With appropriate specification of cost assignment and proration conventions, the result will be uniform cost reporting with capacity to analyze costs in terms of products and their components for purposes of analysis, program description, and resource and cost estimates for adopters.

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[1] See Page 27 Chapter Three.

[2] See Chapter Four, especially Page 73.

C. We recommend that future budgetary work units be constructed in terms of the major developmental products and the service subcomponents and treatment results of the more significant and complex of those products.

D. Estimation of adopter costs should allow for the uncertain degree to which program design and evaluation are part of adopter operations. This can be accomplished by providing an upper estimate which includes Design and Evaluation activity and lower estimate which does not. However, based on subsequent work, ARIES recommends that only Design and Evaluation activity of operational staff be included in the upper estimate. (See Appendix B.)

E. The structure of standard developmental activities should be sufficiently detailed to include those which are secondary and supportive as well as those which apply directly to development of the project products. One benefit of this procedure is that resources and costs allocated to activities unlikely to be continued in an adopter setting can be identified and eliminated from the estimates of adopter cost.

F. Estimation of adopter costs should reflect differences which exist between developers and adopters and among adopters in different circumstances.

G. Two kinds of estimates should be provided. One is applicable to exploratory discussion before a great degree of detail is required. This we called the exploratory estimate. It should begin with resource requirements and apply wages, salaries and other significant resource price values which are national averages for the resources employed in nondevelopmental, or adopter, settings.

The second estimate we termed the adopter incremental estimate. Again one starts with program resource requirements. However, the adopter eliminates the quantities of resources available at no added expense compared to present operations. Then wages and prices are applied. These are to be typical of those found in the adopter market. It is absolutely essential that the physical quantities of most resources be specified with cost built upon that data.

H. Our assessment is that contractors are willing to comply with uniform reporting of program development costs insofar as additional calculations based on their present systems are involved. However, they resist frequent changes in the structure of resource allocation and cost recording which have an impact upon program staff. Consequently, installation of a system like that of Chapter Three and Four may be difficult at this time, but should be considered—with appropriate modification and development—in field tests of the developed programs.

I. Regardless of the data collection system (the categories to which resources and cost are assigned and the procedures for collection of that information), we believe that estimates for adopter cost should be based on upper and lower values, or limits. We also believe that adjustment for differential wage and price levels between adopter and developer settings is important. Moreover, provision must be made for allowance of resources available to adopters at no incremental cost.

J. A list of average adopter prices for significant program resources, particularly staff, should be compiled.

K. Contractors should begin to formulate estimates of the resource requirements of program adoption as soon as possible. We feel that significant problems will be encountered, and that it is best they become apparent now. As far as possible, allocation of significant resources should be in terms of physical units. For the purpose of making these estimates, contractors should be requested to define a set of program service components and to assign resource requirements to them. Contractors should make explicit the source of data and the means of resource assignment. (Measured? How? Prorated? How?) Where no system presently exists, we recommend refinement and installation of a system based on that of Chapters Three and Four. It will be as consistent with other systems as any.

L. Again, if there is interest in anticipating adopter reaction, it would be wise to request a representative sample of potential adopters to identify those program resources (from those compiled under K above) which they will not require due to prior availability.

We have suggested a set of recommendations for reporting the costs of program research development and for estimating adopter costs of program service delivery. If development were just now beginning, we would recommend installation of a system similar to that which evolved through Chapters Three and Four. However, the present programs are well into their projects, and implementation of that system, which is somewhat different from theirs, would be—we feel—resisted as a disturbance to the development effort at this time. Moreover, in some cases, significant data have been lost and institution of a new system will not retrieve lost data. It may, however, provide a better means for its estimation.

Not all of the procedures for estimation of adopter cost depend upon the existence of the system we devised. Specifically, the emphasis on physical requirements and the provision of upper and lower exploratory and of upper and lower incremental which can be adjusted for price and availability adjustments can be applied to many sets of data. The ability to do so will depend upon the degree to which data approximates that which would result from the system we recommended. We strongly recommend that the procedures of the type outlined in this report be considered for application to the estimation process.

M. Nonroutine cost questions for research and development projects, must be specified early in the life of the project. A cost/information system must then be designed which accommodates the questions as specified. If uncertainty exists as to the particular questions to be asked or to the particular data required, then the cost system should be more rather than less detailed. A more detailed system at early stages will assure that cost questions will be answerable. In addition, as questions are further defined and data requirements specified, the system can be simplified rather than complicated when modified. This will increase rather than decrease staff cooperation and morale.

APPENDIX A

FORMAL SPECIFICATION OF COST TREATMENT

Appendix A

FORMAL SPECIFICATION OF COST TREATMENT

In this section we will summarize and refine the abstract content of the cost system whose general characteristics have just been described. We shall be concerned with definitions and transformations which convert data captured by the procedures described above into a form required for entry into the cost report illustrated in Chart II of Chapter Three.

Raw data will fall into two general classifications. The first is that which describes the allocation of resources in terms of physical units. The best illustration is staff time allocations. The second category is data describing the allocation of money payments which are difficult to associate with resources. Transfer payments to students are included in the second category.

Those resources reported in terms of physical units will include both personnel and nonpersonnel resources. Some of these can be traced to specific combinations of subproducts and activities; the remainder can not. The resources which can be traced to specific combinations of subproduct and activity we will call subproduct/activity direct, or simply direct resource allocation. These will be denoted as:

1. L^*_{ijk} = The number of hours allocated directly by the i^{th} personnel resource to the j^{th} product and the k^{th} activity, or

2. R^*_{ijk} = The physical units of the i^{th} nonpersonnel resource allocated directly to the j^{th} product and k^{th} activity.

The time subscript, t, will not be carried in this discussion. However, it should be remembered that all data is dated.

These may be summed across any and all subscript indexes. In particular,

$$3. \qquad L^*_{i..} = \sum_j \sum_k L^*_{ijk} ,$$

will be the total allocation of direct time by the i^{th} staff number.

If CM_i is the compensation accrued by the staff person, then the effective rate of monetary value of compensation will be

4. $w_i = CM_i/L^*_{i..}$,

which is the dollar value assigned to one unit of personnel time.

This rate can be used to assign the cost allocation of staff time to any given combination of product and activity. That is,

5. $(C^L_{ijk})^* = (w_i)\ (L^*_{ijk})$

= The cost of the allocation of time by the ith personnel resource to the jth product and kth activity.

Expression 5 is one fundamental building block in the reporting of research and development costs.

Some nonpersonnel resources also can be directly assigned to a specific combination of product and activity. In cases where the contractor purchases from an outside supplier, the invoice or purchase order can be expected to record the physical quantity of goods or services, the unit price and total charge. It can be structured to assign ordered goods and services to a given purpose or cost center. Where this is the case, the ordering-billing system provides values for

R^*_{ijk} = The quantity of the ith resource allocated to the jth product and kth activity

6. (Statement #2), and

$(C^R_{ijk})^*$ = the cost of the ith nonpersonnel resource directly allocated to the jth product and kth service.

For purposes of reporting research and development costs, C^R_{ijk} will be sufficient. When considering replication resource requirements (see next chapter) the physical quantity, R^*_{ijk}, will be required. The same also applies, of course, to personnel resource units, L^*_{ijk}.

The total of personnel and nonpersonnel costs directly assignable to a given product-activity combination will therefore be,

7. $C^*_{ijk} = (C^L_{ijk})^* + (C^R_{ijk})^*$.

CHART V:
RESEARCH AND DEVELOPMENT EXPENSE REPORT

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Contractor --
Period --

Activities / Product/ Subproducts	1	2	3	4	5	6	7	8	9	10	11	12	13
	Contract Expenses for Period												
	Direct Product/Activity Expenses for Period												
	Design	Application	Evaluation	Total (1+2+3)	Product Finishing	Documentation	Replication	Fundor Negotiation and Liaison	Site Negotiation and Liaison	Staff Recruitment and Training	General Management Housekeeping and Clerical	Total (10+11)	Total Product/Activity Direct
PRIMARY SUB PRODUCTS													
Governance													
Management													
Instructional System		$C^{*}_{\cdot 32}$		$\sum_{k=1}^{3} C_{\cdot 3k}$									$C^{*}_{\cdot 3 \cdot}$
Basic Skills													
Life Skills													
Career Development													
Guidance													
Community Resource Utilization													
Logistics													
Primary Product-wide													
Total Primary Product													
SECONDARY PRODUCTS													
Cost Study													
Control Group Study													
Total Secondary Products													
Total Direct-All Products													
Indirect Assignments													
Staff Indirect			$C^{\# i}_{\cdot(\cdot\cdot 3)}$			$C^{\# i}_{\cdot(\cdot\cdot 5)}$							
Activity Indirect	$C^{\#}_{\cdot(\cdot\cdot 1)}$	$C^{\#}_{\cdot(\cdot\cdot 2)}$			$C^{\#}_{\cdot(\cdot\cdot 4)}$							$C^{\#}_{\cdot(\cdot\cdot 10)}$	
Product Indirect			$C^{i}_{\cdot(\cdot\cdot 5)}$			$C^{\# i}_{\cdot(\cdot\cdot 5)}$							
Total Indirect Activity	$C^{\# \cdot}_{\cdot(\cdot\cdot 1)}$	$C^{\# \cdot}_{\cdot(\cdot\cdot 2)}$			$C^{\# \cdot}_{\cdot(\cdot\cdot 4)}$								$C^{\# \cdot}_{\cdot(\cdot\cdot \cdot)}$
TOTAL PROJECT COSTS	$\bar{C}_{\cdot\cdot 1}$		$\bar{C}_{\cdot\cdot 3}$									$\bar{C}$	

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A-4

CHART V:
RESEARCH AND DEVELOPMENT EXPENSE REPORT (Continued)

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Contractor -- Period --	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	Contract Expenses for Period							Actual-Planned Expenses to Date						
	Indirect Expenses for Period													
Activities Product/ Subproducts	Staff Indirect	Activity Indirect	Product Indirect	Project Indirect	Total (14+15+16+17)	Contractor Indirect	Total Contract Lost for Period (13+18+19)	Total Expenses to Date	Total Non-Expenses Commitments to Date	Total Expenses + Commitments to Date (21 + 22)	Planned Expenses To Date	Discrepancy to Date (23 - 24)	Total Budgeted Expenses	Remaining Funds (26 - 23)
PRIMARY SUB PRODUCTS														
Governance			$C^{\#}_{.(..1.)}$				$C_{.1.}$							
Management		$C^{\#k}_{.(.2.)}$		$C^{\#.}_{.(.2.)}$			$C_{.2.}$							
Instructional System	$C^{\#i}_{.(3.)}$						$C_{.3.}$							
Basic Skills				$C^{\#.}_{.(.4.)}$		$C^{\#i}_{(.3.)}$								
Life Skills														
Career Development	$C^{\#i}_{.(.6.)}$													
Guidance														
Community Resource Utilization		$C^{\#k}_{.(.8.)}$												
Logistics														
Primary Product-wide														
Total Primary Product														
SECONDARY PRODUCTS														
Cost Study														
Control Group Study			$C^{\#}_{.(.12.)}$											
Total Secondary Products														
Total Direct-All Products	$C^{\#}_{.(I..)}$		$C^{\#}_{.(...)}$			$C^{\#c}$								
Indirect Assignments														
Staff Indirect														
Activity Indirect		$C^{\#}_{.(..k)}$												
Product Indirect			$C^{\#}_{.(...)}$											
Total Indirect Activity						$C^{\#c}$								
TOTAL PROJECT COSTS						$C^{\#c}$	C							

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The quantity given by the sum over all resources, or

8. $$C^*_{.jk} = \sum_{i=1}^{m} C^*_{ijk} ,$$

is the cost of all resources directly assigned to the product-activity combination. It is this value which is to be entered in the research and development cost report reproduced in Chart V. In like manner, the quantity,

9. $$C^*_{..k} = \sum_{j=1}^{n} C^*_{.jk} , \quad (k = 1 \,....s)$$

is the cost of resources directly traced to the kth activity, summed for all subproducts and products. Similarly,

10. $$C^*_{.j.} = \sum_{k=1}^{s} C^*_{.jk} \quad (j = 1, \ldots, m)$$

is the cost of all resources directly traced to the sum of all activities under the jth product.

The second large category of resource allocation and expenditures are those which cannot be traced to a given product-activity combination. Such resources, when measured in physical quantities, will be indicated by a notation $R^{\#}_{h}$. When measured in money value, the notation will be $C^{\#}_{h}$. The subscript, h, indicates the resource, and h = 1, 2, ...m. The superscript, #, indicates that the resource and cost is not product-activity direct.

Of these resources, not all will be treated identically. Some can be traced as far as a particular staff member. These will be called staff-indirect and will be indicated by the notation

11. $R^{\#}_{h(i..)}$ = The quantity of the hth resource traced to the ith personnel resource and,

12. $C^{\#}_{h(i..)}$ = The cost of the hth resource traced to the ith personnel resource.

We will allow

13. c_h = The unit price of the hth resource

so that

14. $$C^{\#}_{h(i..)} = (c_h)\, R^{\#}_{h(i..)}$$

Some indirect resources and costs will be traced only as far as a given subproduct. These will be termed product-indirect and indicated by

15. $R^{\#}_{h(.j.)}$ = The quantity of the h^{th} resource traced to the j^{th} product, and

16. $C^{\#}_{h(.j.)}$ = The cost of the h^{th} resource traced to the j^{th} product.

Others will be traced only as far as a given activity. These will be defined as activity-direct and indicated by

17. $R^{\#}_{h(..k)}$ = The quantity of the h^{th} resource traced to the k^{th} activity, and

18. $C^{\#}_{h(..k)}$ = The cost of the h^{th} resource traced to the k^{th} activity.

Finally, resources and costs will be traced only as far as the project itself. These we will call project-indirect. They will be denoted by

19. $R^{\#}_{h(...)}$ = The quantity of the h^{th} resource traced to the project, and

20. $C^{\#}_{h(...)}$ = The cost of the h^{th} resource traced to the project.

Since the units of these resources differ they cannot be aggregated. However, their cost can be aggregated as

21. $C^{\#}_{.(i..)} = \sum_{h=1}^{m} C^{\#}_{h(i..)}$

= The total of all staff-direct resource cost traced to the i^{th} staff member;

22. $C^{\#}_{.(I..)} = \sum_{i=1}^{m} C^{\#}_{.(i..)}$

= The total of all staff-indirect resource cost traced to individual staff members, summed for all staff.

(This is entered at the intersection of row 30 and column (14) in Chart V.)

23. $C^{\#}_{.(.j.)} = \sum_{h=1}^{m} C^{\#}_{.(.j.)}$,

= The total of all product-indirect resource cost traced to the j^{th} product;

(This is entered in the cells of column (16), Chart V.)

24. $C^{\#}_{.(..k)} = \sum_{h=1}^{m} C^{\#}_{.(..k)}$,

= The total of all activity-indirect resource costs traced to the k^{th} activity; and

(This is entered in the cells of row 34, Chart V.)

25. $C^{\#}_{.(...)} = \sum_{h=1}^{m} C^{\#}_{h(...)}$,

= The total of all project-direct costs traced to the project.

(This is entered in the intersection of row 20 and column (p).

These indirect costs as so recorded are not assigned through proration to categories of cost beyond the point to which the cost can be traced. As stated above, we do not favor proration since it is arbitrary and lends an atmosphere of precision to cost figures which are not precise. Moreover, to the extent that costs are interpreted as increasing directly with changes in the level of activity, the imposition of prorated indirect costs may actually be misleading.

Nonetheless, we recognize the strong tendency to assign indirect costs. The cost report makes provision for that. Therefore, we will conclude this section with a discussion of cost proration and assignment.

Staff-indirect costs are assigned as follows: Recall

$R^{\#}_{h(i..)}$ = The quantity of the h^{th} resource traced to the i^{th} staff member,

(Here we assume that indirect costs are nonpersonnel. To the extent this is not true the variable $L^{\#}_{h(i..)}$ can be defined)

$$C^{\#}_{h(i..)} = (c_h)\ R^{\#}_{h(i..)}$$, and

$$C^{\#}_{.(i..)} = \sum_{h=1}^{m} C^{\#}_{h(i..)}$$

Staff-indirect costs will be assigned on the basis of personnel direct costs of the i^{th} staff member. That is,

$$L^{*}_{(i..)} = \sum_{j=1}^{n} \sum_{k=1}^{s} L^{*}_{ijk}$$

Then we may form the ratio,

26. $$r_i = C^{\#}_{.(i..)} \ / \ L^{*}_{(..)} \ .$$

Then,

27. $$C^{\#}_{.(ijk)} = (r_i)\ L^{*}_{ijk} \ .$$

This value is not recorded in the cost report.

However, we may now form

28. $$C^{\#i}_{.(.j.)} = \sum_{i=1}^{m} \sum_{k=1}^{s} C^{\#}_{.(ijk)} ,$$

= The assignment of staff indirect costs to the j^{th} product.

These values are entered in column 14 of the cost report.

These values can be recorded in column (m) of the cost report.

Similarly we may form

29. $$C^{\#i}_{.(..k)} = \sum_{i=1}^{m} \sum_{j=1}^{n} C^{\#}_{.(ijk)} ,$$

= The assignment of staff-indirect costs to the k^{th} activity.

These are entered in row 33 of the cost report.

Product-indirect costs are recorded without proration into column (o) of the report. However, to apportion these costs to activities, we must form

30. $r_j = C^{\#}_{.(.j.1)} / L^{*}_{.j.}$, and

31. $C^{\#}_{.(ijk)} = (r_j)(L^{*}_{ijk})$.

Summing, we arrive at

32. $C^{\#j}_{.(..h)} = \sum_{i=1}^{m} \sum_{k=1}^{s} C^{\#}_{.(ijk)}$,

which is recorded in row 35 of the report.

Activity-indirect costs are recorded *without proration* into row 18 of the report. However, to apportion these across product categories, we must form

33. $r_k = C^{\#}_{.(..k)} / L^{*}_{..k}$, and

34. $C^{\#}_{.(ijk)} = (r_k) \; (L^{*}_{ijk})$.

Summing, we produce

35. $C^{\#k}_{.(.j.)} = \sum_{i=1}^{m} \sum_{j=1}^{m} C^{\#}_{.(ijk)}$,

which is recorded in column (15) of the cost report.

Finally, we consider project-wide costs. These are entered *without proration* in the cells at the intersections of rows 30 and 36 with column (17). However to apportion these across product categories, we must form,

36. $r_{(.)} = C^{\#}_{.(...)} / L^{*}_{...}$, and

37. $C^{\#}_{.(.j.)} = (r_{(.)}) \; (L^{*}_{.j.})$,

which is the proration of project direct costs to each product and is entered down column 17, and

38. $C^{\#}_{.(..k)} = (r_{(.)}) \; (L^{*}_{..k})$,

which is the proration of these costs to each activity and is entered across row 36.

We have referred to those indirect costs which cannot be traced to any specific project of the contractor. They are termed project-indirect costs and are denoted as

39. $C^{\#c}$.

These are apportioned to the project by the contractor. Their value is entered at the intersections of rows 30, 36, and 38 with Column (19). The chart does not make provision for further apportionment to activities. Proration to products, however, is provided for, and is accomplished by forming

40. $r_c = C^{\#c} / L^{*}_{(...)}$, then

41. $C^{\#c}_{(.j.)} = (r_c)\ (L^{*}_{.j.})$, $(j = 1, 2 \ldots n)$

the values of which are entered down Column (19).

In this discussion we have pointed to the distinction between resources dimensioned in physical units and the value of resources denominated in money units as cost. However, the research and development cost report is in terms of dollars. Therefore, whatever has been stated above with respect to costs derived from physical units also applies to costs derived, due to reasons either of principle or of practicality, in money values only. Thus the cost figures should be considered to include them.

That being the case, the remaining entries in the cost report are formed as

42. $C = C^{*} + C\#$

= The sum of costs direct to product/activity categories and costs which cannot be traced directly to that extent (and which therefore are indirect to product/activity classifications).

In the table, $\bar{C}$ indicates cost totals with contractor-indirect costs excluded. Such totals appear in row 38. C indicates cost totals with contractor-indirect costs included. These are recorded for each product and various totals in Column (20).

APPENDIX B

A REPORT OF ARIES'
SECOND COST ANALYSIS
OF NWREL

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2.0 Work Effort. B-2

3.0 Work Results B-2

4.0 Conclusions B-26

Exhibit A B-29

APPENDIX B

1.0 Introduction

This work was commissioned subsequent to completion of ARIES' report, Design, Assessment, and Recommendations for Reporting Education Program Research and Development Costs and for Estimating Service Delivery Costs of Program Adoptors, of March, 1974. The report outlined a framework for a cost-resource reporting system which would enable NIE to accomplish two goals:

(1.) To uniformly report research and development costs across programs. Such a system would have to employ uniform categories and procedures to be meaningful.

(2.) To report costs in such a manner so as to promote dissemination of program results to operational applications. Accomplishment of this objective requires that, in addition, cost be structured on the basis of the principle components of the particular program under research and development. The more extensive the program the more complex the structure of the required cost system. Such a system will not be general, or uniform, in the sense above. Its categories for report will be specific and unique to the program. However, the reporting procedures and assignment rules should be as uniform across laboratories and contractors as possible.

The work to be reported in this document had several purposes and results. The first was to determine the degree to which the ARIES cost data could be completed - after the fact through an analysis of prior records. The second was related: To illustrate the result of such a system. The third was to provide a basis for revision of the first ARIES report.

Northwest Regional Educational Laboratory (NWREL), Portland, Oregon was selected as the application site.

Work was executed under a severe restriction — the investigator was not permitted to contact department staff. This is a severe, but understandable constraint. Operational staff strongly feel compromised when complying with numerous tasks and requirements which are not directly related to operational activity. Secondly, the present system is the fourth cost system for staff at Northwest Regional Educational Laboratory.

Staff can hardly be blamed for viewing involvement with yet another system with some disinterest. Subject to the above severe restriction, the investigator received full and open cooperation at NWREL.

2.0 Work Effort

The work proceeded in several stages. First, the investigator met with the NWREL project director and clarified the nature of the task and established "cross walk" relations between NWREL/NIE and ARIES categories insofar as possible and in order to establish sources for the required data. The result was outlined in a letter from ARIES to NWREL. The relevant material is included as Exhibits A-1 through A-25.

In the second task, the investigator identified and analyzed the original source records for a given period. The month of March, 1974, was selected. The result was a detailed assignment of item costs to NWREL categories. The expenditures assigned to NWREL categories were reassigned to those specified by ARIES. This was accomplished on the basis of the cross walk established in the second step and of interviews of those staff accessible to the investigator. Ideally, NWREL cost data should have been categorized into both ARIES systems that required for the ARIES Standard Report Categories which describe R & D activity and that required for the particular categories required for the activities specific to Experience Based Career Education (EBCE) at NWREL which is the basis for estimating adopter costs. However, due to the restrictions noted above the latter was not accomplished.

3.0 Work Results

The results of ARIES' transformation is displayed in the following two charts. Chart I contains the assignment of costs assigned to NWREL. Chart II contains the assignment of costs assigned to a NWREL subcontract, that of CE_2, the operational EBCE school organization. Each chart lists expenditure items as structured by NWREL and CE_2 accounts in the left hand Item Column. In Chart I, the remaining numbered columns report:

Column 1: NWREL Overhead Allocation
Column 2: NWREL General Telephone and Facility Rental Allocation
Column 3: NWREL Allocation
Column 4: Assignment of NWREL Allocation to ARIES Design Category
Column 5: Assignment of NWREL Allocation to ARIES Application Category

CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

I/1

	NWREL Overhead Allocation	Telephone and Facility Allocation	NWREL Assignment	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
118 - 0900: CE_2 Operations													
Duplication													
MS181N			− 118^{35}		− 118^{35}								
Subcontracts and Agreements													
035854			17056^{23}										
		1083^{08}	11913^{92} }										
		338^{77}	3720^{95} }										
Indirect Allocation	3472^{26}												
118 - 1010: Dissemination													
Salaries and Benefits													
L. McClure			3 377^{17}						1.5 189^{09}	1.5 189^{08}			
T. Owens			6 797^{40}						3.0 398^{70}	3.0 398^{70}			
Office Supplies			16^{97}						8^{48}	8^{49}			
Facility Allocation		53^{46}											
Telephone Allocation		16^{56}											
Indirect Allocation	255^{35}												
118 - 1110: NWREL													
Development - Governance													
Salaries and Benefits													
R. Hagens			0.5 73^{88}	0.5 73^{88}									
Facilities Allocation		2^{97}											
Telephone Allocation		0^{92}											
Indirect Allocation	15^{94}												
118 - 1210: NWREL													
Development - Management													
Salaries and Benefits													
R. Hagens			0.5 73^{88}	0.5 73^{88}									
Facilities Allocation		2^{97}											
Telephone Allocation		0^{92}											
Indirect Allocation	15^{94}												

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CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

	NWREL Overhead Allocation	Telephone & Facility Allocation	NWREL Assignment	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
118 - 1510: NWREL Development-Life Skills													
Consultants (C. Auch)			56 -					56 -					
Duplication			5 -					5 -					
Indirect Allocation	73^{51}												
118 - 1610: NWREL Development-Career Devel.													
Salaries and Benefits													
I. Boslaugh			15 1302^{49}	13.5 1172^{24}					0.75 65^{13}	0.15 65^{12}			
S. Stannard			20.18 725^{27}	18.35 652^{92}					1.02 36^{27}	1.02 36^{28}			
Long Distance Telephone			1^{49}	1^{34}					0^{02}	0^{00}			
Facility Allocation		120^{81}											
Telephone Allocation		37^{44}											
Indirect Allocation	448^{49}												
118 - 1710: NWREL													
Development - Guidance Consultant (M. Ward)			300 -	300 -									
Staff Travel													
S. Kannenberg			253 -	253 -									
Indirect Allocation	113 -												
118 - 2010: NWREL Formative Evaluation Publications			12 -			12 -							
118 - 2510: NWREL Evaluation													
Salaries and Benefits													
K. Hamada			2.0 60^{53}			2.0 60^{53}							
K. Peterson			21 817^{74}			21 817^{74}							

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CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

	NWREL Overhead Allocation	Telephone and Facility Allocation	NWREL Assignment	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
118 - 2510 (Continued)													
Consultant Claims													
E. Rogers			240-			240-							
F. Forester			420-			420-							
E.A. Bergstrom			50-			50-							
G.W. Wright			50-			50-							
L. Hathaway			50-			50-							
Staff Travel													
The LaSalle			20-									20-	
Consultant Travel													
E. Rogers			11^{85}			11^{85}							
Postage and Shipping			13^{62}			13^{62}							
Long Distance Telephone													
J. Fletcher			54^{44}			34^{32}				20^{12}			
H. Fahrenbacher			2^{33}			2^{33}							
Data Processing													
Student Opinion Quest.			34^{32}			34^{32}							
Parent Questionnaire			17^{32}			17^{32}							
CMI and PSI			110^{48}			110^{48}							
Employer Questionnaire			6^{06}			6^{06}							
Work Orientation			2^{00}			2-							
CMI Study			17-			17-							
Office Supplies			24^{25}			24^{25}							
Printed Materials													
NWREL Library			1-			1-							
Wadsworth Pub.			- 1^{03}			1^{03}							
Telephone Allocation		42^{32}											
Facility Allocation		136^{63}											
Indirect Allocation	452^{01}												

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CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

	NWREL Overhead Allocation	Telephone & Facility Allocation	NWREL Assignment	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
118 - 2511: NWREL													
Evaluation - Governance													
Salaries and Benefits													
H. Fehrenbacker			2.0 124^{58}			2.0 124^{58}							
M.D. Herron			1.0 116^{96}			1.0 116^{96}							
T.R. Owens			1.0 132^{92}			1.0 132^{92}							
Telephone Allocation		7^{36}											
Facility Allocation		23^{76}											
Indirect Allocation	83^{14}												
118 - 2512: NWREL													
Evaluation - Management													
Salaries and Benefits													
H. Fehrenbacker			2.0 124^{58}			2.0 124^{58}							
M.D. Herron			1.0 116^{96}			1.0 116^{96}							
T.R. Owens			2.0 265^{82}			2.0 265^{82}							
Telephone Allocation		9^{20}											
Facility Allocation		29^{70}											
Indirect Allocation	111^{90}												
118 - 2513: NWREL													
Evaluation - Inst. Supt.													
Salaries and Benefits													
H. Fehrenbacker			2.0 124^{58}			2.0 124^{58}							
M.D. Herron			7.0 818^{71}			7.0 818^{71}							
T.R. Owens			2.0 265^{82}			2.0 265^{82}							
Telephone Allocation		20^{24}											
Facility Allocation		65^{35}											
Indirect Allocation	265^{41}												
118 - 2514: NWREL													
Evaluation - Basic Skill													
Salaries and Benefits													
H. Fehrenbacker			2.0 124^{58}			2.0 124^{58}							
M.D. Herron			2.0 233^{92}			2.0 233^{92}							
T.R. Owens			2.0 265^{82}			2.0 265^{82}							

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CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

	1 NWREL Overhead Allocation	2 Telephone & Facility Allocation	3 NWREL Assignment	4 Design	5 Application	6 Evaluation	7 Product Finishing	8 Documentation	9 Diffusion	10 Fundor Negotiation & Liaison	11 Site Negotiation & Liaison	12 Staff Recruitment & Training	13 General Admin., Etc.
118 - 2514: (Continued)													
Telephone Allocation		11^{04}											
Facilities Allocation		35^{64}											
Indirect Allocation	137^{56}												
118 - 2515: NWREL													
Evaluation - Life Skills													
Salaries and Benefits													
H. Fehrenbacker			3.0 186^{85}			3.0 186^{85}							
M.D. Herron			2.0 233^{92}			2.0 233^{92}							
T.R. Owens			1.0 132^{91}			1.0 132^{91}							
Telephone Allocation		11^{04}											
Facility Allocation		35^{64}											
Indirect Allocation	123^{07}												
118 - 2516: NWREL													
Evaluation - Career Devel.													
Salaries and Benefits													
H. Fehrenbacker			4.0 249^{12}			4.0 249^{12}							
M.D. Herron			2.0 233^{92}			2.0 233^{92}							
T.R. Owens			3.0 398^{70}			3.0 398^{70}							
Telephone Allocation		16^{56}											
Facility Allocation		53^{46}											
Indirect Allocation	195^{11}												
118 - 2517: NWREL													
Evaluation - Guidance													
Salaries and Benefits													
H. Fehrenbacker			3.0 186^{85}			3.0 186^{85}							
M.D. Herron			2.0 233^{92}			2.0 233^{92}							
T.R. Owens			3.0 398^{70}			3.0 398^{70}							
Telephone Allocation		14^{72}											
Facility Allocation		47^{53}											
Indirect Allocation	180^{75}												

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CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

	NWREL Overhead Allocation	Telephone & Facility Allocation	NWREL Assignment	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
118 - 2518: NWREL Evaluation - Community Resource													
Salaries and Benefits													
H. Fehrenbacker			3.0 186^{85}			3.0 186^{85}							
M.D. Herron			3.0 350^{88}			3.0 350^{88}							
T.R. Owens			1.0 132^{91}			1.0 132^{91}							
Telephone Allocation		12^{88}											
Facility Allocation		41^{58}											
Indirect Allocation	148^{65}												
118 - 2520: NWREL Evaluation - Form. & Summative													
Payments to CE$_2$ Graduates			37^{10}			37^{10}							
Duplication													
Interim Eval. Report			911^{90}							911^{90}			
Indirect Allocation	199^{55}												
118 - 4120: NWREL Product Development													
Salaries and Benefits													
N. Anderson			12.0 816^{49}				4.5 282^{65}	4.5 282^{65}	2.0 125^{62}	2.0 125^{62}			
A. Buss			3.0 188^{41}				3.0 188^{41}						
M. Coffin			8.5 341^{59}				4.25 170^{79}	4.25 170^{79}					
M. Douglas			4.0 234^{70}				4.0 234^{70}						
K. Hamada			9.0 272^{38}				4.0 121^{05}		2.0 60^{53}	3.0 90^{80}			
L. McClure			9.0 1134^{48}				8.0 1008^{48}			1.0 126–			
P. Taylor			14.75 578^{15}				14.75 578^{15}						
Staff Travel													
Use of Auto			3^{12}										
Postage and Shipping			78^{63}				9–		9–	60^{63}			
Long Distance Telephone			33^{05}				16–			17^{05}			

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CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

	NWREL Overhead Allocation	Telephone and Facility Allocation	NWREL Assignment	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
118 - 4120: (Continued)													
Duplication													
Media Center			1002^{15}		101^{23}				11^{18}	889^{75}			
Xerox			298^{71}					298^{71}					
Office Supplies													
Pacific Stationary		—	28^{42}				— 2^{42}		— 1—	— 25—			
Kilhams			33^{70}				2^{70}		1—	30—			
March Supply Charge			117^{25}				10—		7^{25}	100—			
Printed Materials													
Educational Properties			10—						10—				
ACT Publication			1—				1—						
Telephone Allocation		112^{70}											
Facility Allocation		363^{81}											
Indirect Allocation	1151^{76}												
118 - 4121: NWREL Prod. Devel. - Governance													
Salaries and Benefits													
A. Baas			0.50 31^{41}				0.50 31^{41}						
Duplication													
Student Portfolio Form			51^{25}				31^{25}		20—				
Telephone Allocation		0^{92}											
Facility Allocation		2^{97}											
Indirect Allocation	17^{74}												
118 - 4123: NWREL													
Prod. Devel. - Instr. System													
Salaries and Benefits													
R. Anderson			8.0 502^{45}							8.0 502^{45}			
A. Baas			16.0 1004^{84}				16.0 1004^{84}						
M. Douglas			8.0 469^{41}				4.0 234^{71}			4.0 234^{71}			
L. McClure			1.0 126^{06}				1.0 126^{06}						
Telephone Allocation		60^{71}											
Facility Allocation		196^{01}											
Indirect Allocation	483^{71}												

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CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

	NWREL Overhead Allocation	Telephone and Facility Allocation	NWREL Assignment	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
118 - 4125: NWREL													
Prod. Devel. - Life Skills													
Salaries and Benefits													
N. Douglas			1.6 93^{58}				1.6 93^{58}						
Telephone Allocation		2^{94}											
Facilities Allocation		9^{50}											
Indirect Allocation	21^{60}												
118 - 4128: NWREL													
Prod. Devel. - Community Resources													
Salaries and Benefits													
A. Baas			1.25 78^{51}				1.25 78^{51}						
Duplication													
Empl. Data Sheets (400)			139^{25}				4^{62}	4^{63}	130 –				
Empl. Info. Packet (200)													
Office Supplies													
Kilhams			14^{96}				14^{96}						
Telephone Allocation		2^{30}											
Facilities Allocation		7^{43}											
Indirect Allocation	49^{70}												
118 - 4220: NWREL													
Product Documentation													
Other Supplies													
Boise Cascade			11^{49}					11^{49}					
Indirect Allocation	2^{36}												
118 - 5010: NWREL													
Cost Installation Study													
Salaries and Benefits													
R. Hagens			0.5 73^{68}						0.5 73^{68}				
J. Kerkpatrick			9.0 1057^{27}						9.0 1057^{27}				
D. Randall			0.5 24^{97}						0.5 24^{97}				

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CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

	1 NWREL Overhead Allocation	2 Telephone & Facility Allocation	3 NWREL Assignment	4 Design	5 Application	6 Evaluation	7 Producat Finishing	8 Documentation	9 Diffusion	10 Fundor Negotiation Liaison	11 Site Negotiation & Liaison	12 Staff Recruitment & Training	13 General Admin., Etc.
118 - 5010: (Continued)													
Duplication (Xerox)			1^{89}					1^{89}					
Conference													
Stockpot			90^{90}						90^{90}				
Telephone Allocation		24^{29}											
Facility Allocation		64^{24}											
Indirect Allocation	294^{68}												
118 - 6100: NWREL													
Salaries and Benefits													
A. Boas			0.25 15^{71}						0.25 15^{71}				
R. Hagens			0.50 73^{88}						0.50 73^{88}				
L. McClure			4.0 504^{22}						4.0 504^{22}				
Consultant Travel													
R. Rhyme			158^{17}						158^{17}				
Duplication			96^{10}						96^{10}				
Rent-Tiralatin Devel. Co.			2887^{50}										
		481^{25}	2406^{25}										
Telephone Allocation		8^{74}											
Facilities Allocation		28^{21}											
Indirect Allocation	773^{32}												
118 - 9010: NWREL													
Program Admin.													
Salaries and Benefits													
C. Jordan			4.0 624^{74}										4.0 624^{74}
A. Street			1.0 41^{88}										1.0 41^{88}
Telephone Allocation		21^{35}											
Facility Allocation		53^{75}											
Indirect Allocation	153^{95}												

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CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

	NWREL Overhead Allocation	Telephone & Facility Allocation	NWREL Assignment	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
118 - 9020, 30: NWREL													
Program Admin.													
Salaries and Benefits													
M. Coffin			7.50 301.40										7.5 301.40
E.G. Gross			19.50 1015.62						3.0 156.24	8.5 642.69		1.0 52.08	7.0 364.56
R. Hagens			16.50 2281.10							8.0 1181.58	2.0 295.51		6.5 957.94
K. Hamada			9.0 272.38										9.0 272.48
L. McClure			4.0 504.23										4.0 504.22
P. Taylor			6.25 247.49										6.25 247.19
M. Douglas			3.2 187.76										3.2 181.16
Staff Travel													
R. Hagens			24.40						24.40				
R. Hagens - National Car			21.14						21.14				
R. Hagens - Julies Travel			103.21			103.21							
March Use of Lab Car			3.60			3.60							
M.D. Huron			32.40			32.40							
T.R. Owens			231.11									231.11	
H. Fehrenbacker			120.–							120.–			
Other Travel													
T. Garel (Student)			69.27						69.27				
G. Ullrich (Student)			69.27						69.27				
Postage and Shipping			1.80										1.80
Long Distance Telephone													
R. Hagens			85.46							66.06			19.40
F. Young			8.41										8.41
Duplication			117.–						10.–	107.–			
Conference Expenses													
Riverside West			17.06							17.06			
R. Hagens			114.–							114.–			
Office Supplies													
March Supply (20)			13.40										13.40
March Supply (30)			6.–										6.–

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CHART I: Assignment of NWREL
Laboratory Costs to ARIES
Standard Categories

	NWREL Overhead Allocation	Telephone & Facility Allocation	NWREL Assignment	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
118 - 9020, 30: (Continued)													
Telephone Allocation (20)		63^{94}											
Telephone Allocation (30)		57^{40}											
Facilities Allocation (20)		206^{41}											
Facilities Allocation (30)		185^{32}											
Indirect Allocation (20)	735^{74}												
Indirect Allocation (30)	604^{36}												
118 - 9050: NWREL ESCE Model Prog. Admin.													
Equipment Rental			235-							235-			
Coordination			- 145-							- 145-			
Indirect Allocation	96^{35}												
Column Totals (Ex. 3)	10672^{24}	4226^{26}		2527^{26}	-17^{32}	7791^{28}	4231^{76}	832^{16}	3507^{75}	6170^{26}	295^{57}	303^{19}	3557^{61}
Sub Totals		14898^{50}		29199^{49}									
NWREL Totals			44097^{99}										
Reserve for Rent			16041^{12}										
NWREL Grand Total			62139^{11}										

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Column 6: Assignment of NWREL Allocation to ARIES Evaluation Category
Column 7: Assignment of NWREL Allocation to ARIES Product Finishing Category
Column 8: Assignment of NWREL Allocation to ARIES Documentation Category
Column 9: Assignment of NWREL Allocation to ARIES Diffusion Category
Column 10: Assignment of NWREL Allocation to ARIES Fundor Negotiation and Liaison Category
Column 11: Assignment of NWREL Allocation to ARIES Site Negotiation and Liaison Category
Column 12: Assignment of NWREL Allocation to ARIES Staff Recruitment and Training Category
Column 13: Assignment of NWREL Allocation to ARIES General Clerical, Administration and Housekeeping Category

When reporting personnel costs, columns 3 through 13 contain dollar figures entered to right and person days to the left. Chart I-11 presents the NWREL totals for each column in line 20, the totals of all indirect allocations based on prorations and all direct allocations are reported in line 21. Line 24 records the assignment of rent payments in excess of one month to rent reserve. Line 26 is the total of all NWREL costs.

Chart II contains the following categories:

Column 2: Total for Assignments Prorated According to Convention by CE_2
Column 3: Assignment as reported by CE_2
Column 4: Assignment of CE_2 Allocation to ARIES Design Category
Column 5: Assignment of CE_2 Allocation to ARIES Application Category
Column 6: Assignment of CE_2 Allocation to ARIES Evaluation Category
Column 7: Assignment of CE_2 Allocation to ARIES Product Finishing Category
Column 8: Assignment of CE_2 Allocation to ARIES Documentation Category
Column 9: Assignment of CE_2 Allocation to ARIES Diffusion Category
Column 10: Assignment of CE_2 Allocation to ARIES Fundor Negotiation and Liaison Category
Column 11: Assignment of CE_2 Allocation to ARIES Site Negotiation and Liaison Category
Column 12: Assignment of CE_2 Allocation to ARIES Staff Recruitment and Training Category
Column 13: Assignment to ARIES General Clerical, Administration, and Housekeeping Category

With respect to cost assignments by CE_2 based on proration convention, Column 2 gives the total cost to be prorated and Column 3 gives the prorated amount by CE_2. The remaining columns report ARIES assignment of the total. This will be the case for the first entry of the prorated items by CE_2. For all subsequent entries of prorated quantities by CE_2 as reported in Column 3, there will be no entry in any other columns.

Again, the final page of Chart II, Chart II-6 presents totals: Line 33 reports CE_2 column totals for Columns 3-13. Line 34 reports NWREL Column totals as transferred from Chart I - 11, line 20. Line 35 reports totals of the entries in lines 32 and 33. Line 37 reports the Rent Reserve Allocation. The total of all NWREL and CE_2 expenditures is given in line 38. The percents that the sum of NWREL and CE_2 costs in each column is of total costs exclusive of Rent Reserve are reported in line 40. Line 41 reports the rank of each ARIES standard report category. Chart III summarizes the data from Chart II.

CHART II: Assignment of NWREL CE_2 Costs to ARIES Standard Categories

	Total for Prorated Items	CE_2 Allocation	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
998 - 0010: CE_2												
Dissemination												
Salaries and Benefits												
J. Beier		1.55 208.22						0.755 104.11	0.755 104.11			
D. Hunter		4.80 375.61						2.40 187.81	2.40 187.80			
J. Morehouse		1.0 77.06						0.50 38.53	0.50 38.53			
V. Thompson		0.50 42.12						0.25 21.06	0.25 21.06			
K. Wood		2.20 185.35						1.10 92.68	1.10 92.68			
Duplication												
NWREL	90.50	9.05		81.45				9.05				
NWREL	12.10	1.21		10.89				1.21				
Other Supplies												
NWREL		1.57		1.57								
Petty Cash		3.49		3.49								
Program Supplies		9.24		9.24								
998 - 0020: CE_2												
Development												
Salaries and Benefits												
J. Beier		9.36 1237.39	9.36 1237.39									
W. Black		2.65 145.70	2.65 145.70									
D. Hunter		2.20 211.29	2.20 211.29									
S. Kaneubery		3.70 285.03	3.70 285.03									
J. Morehouse		0.30 23.11	0.30 23.11									
V. Thompson		7.20 666.62	7.20 666.62									
K. Wood		6.45 543.43	6.45 543.43									
Consultant Claims		1240 -		1240 -								
Staff Travel												
D. Hunter		16.95	16.95									
Petty Cash		0.95	0.95									
Transportation of Things												
Postmaster	20 -	18 -	18 -									
Postmaster	20.50	18.45	18.45									

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CHART II: Assignment of NWREL
CE_2 Costs to ARIES
Standard Categories

	Total for Prorated Items	CE_2 Allocation	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
998 - 0020: (Continued)												
Other Supplies												
Kilham Stationery		5^{11}	5^{11}									
Conference Expenses												
L. Morehouse	38^{20}	15^{28}	7^{64}	15^{28}				7^{64}	7^{64}			
VIP's Restaurant	32^{43}	12^{97}	6^{49}	12^{96}				6^{49}	6^{49}			
L. Morehouse	16^{34}	6^{54}	3^{26}	6^{56}				3^{26}	3^{26}			
D. Hunter	17^{25}	6^{90}	3^{45}	6^{90}				3^{45}	3^{45}			
J. Beier	13^{75}	5^{50}	2^{75}	5^{50}				2^{75}	2^{75}			
D. Hunter	11^{50}	4^{60}	2^{30}	4^{60}				2^{30}	2^{30}			
Rose's Restaurant	50-	20-	10-	20-				10-	10-			
Petty Cash	9^{05}	3^{62}	1^{81}	3^{62}				1^{81}	1^{81}			
Petty Cash	21^{05}	8^{42}	4^{21}	8^{42}				4^{21}	4^{21}			
Petty Cash		12^{69}	9^{33}									
Petty Cash	13^{00}	5^{20}	2^{60}	5^{20}				2^{60}	2^{60}			
Program Supplies												
R.E. Sullivan	15^{-}	4^{50}	4^{50}	10^{50}								
Nelson Tire Co.	88^{10}	26^{43}	26^{43}	61^{67}								
Petty Cash	2^{31}	2^{31}	2^{31}									
Petty Cash	2^{76}	0^{83}	0^{83}	1^{93}								
Refund-Check #1110	-1^{11}	-0^{33}	-0^{33}	-0^{78}								
Subcontracts & Agree.												
All States Leasing	128^{44}	38^{53}	38^{53}	89^{91}								
Telephone	344^{15}	309^{74}	309^{74}	34^{41}								
998 - 0910: CE_2 Operations - Prog. Admin.												
Salaries and Benefits												
J. Beier		5.47 734^{83}		5.47 734^{83}								
J. Kilgore		13.0 887^{53}		180 887^{53}								
Duplication												
NWREL		18^{10}										
NWREL		2^{42}										

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CHART II: Assignment of NWREL
CE$_2$ Costs to ARIES

Standard Categories

	Total for Prorated Items	CE$_2$ Allocation	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment	General Admin., Etc.
99B - D910: (Continued)												
Conference Expenses												
L. Morehouse		7^{64}										
VIP's Restaurant		6^{49}										
J.L. Morehouse		3^{36}										
D. Hunter		3^{45}										
J. Beier		2^{75}										
D. Hunter		2^{30}										
Posh's Restaurant		10-										
Petty Cash		1^{8}										
Petty Cash		4^{21}										
Petty Cash	8^{40}	1^{68}	1^{68}	3^{36}				1^{68}	1^{68}			
Petty Cash		2^{60}										
Other Services												
Arthur Andersson & Co.		650-	350-	300-								
Oregon Community Edn. Assn.		25-		25-								
Office Supplies												
Southwest		72^{62}		72^{62}								
NWREL		122^{80}		122^{80}								
Petty Cash		2^{20}		2^{20}								
Petty Cash		2-		2-								
Other Supplies (NWREL)		3^{15}		3^{15}								
99b - D920: CE$_2$												
Operations - Enabling Costs												
Salaries and Benefits												
J. Beier		4.46 599^{14}		4.46 599^{14}								
W. Black		2.80 153^{95}		2.80 153^{95}								
D. Hunter		3.78 295^{90}		3.78 295^{90}								
S. Karnenbe		0.40 30^{83}		0.40 30^{83}								
J. Morehouse		5.75 443^{12}		5.75 443^{12}								

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CHART II: Assignment of NWREL CE_2 Costs to ARIES

Standard Categories

	Total for Prorated Items	CE_2 Allocation	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
998 - C930: CE_2												
Operations - Instruct. Supt.												
Salaries and Benefits												
J. Beier		0.16 21^{50}		0.16 21^{50}								
W. Block		15.55 855–		15.55 855–								
D. Hunter		9.72 760^{62}		9.72 760^{62}								
S. Kannenberg		13.50 1071^{12}		13.50 1071^{12}								
D. Martyn		20.10 672^{51}		20.10 672^{51}								
J. Morehouse		13.45 1075^{09}		13.45 1075^{09}								
V. Thompson		11.80 944^{12}		11.80 944^{12}								
K. Wood		7.35 619^{24}		7.35 619^{24}								
Part - Time Employee		420–		420–								
Tutors		849–		849–								
Duplication												
NWREL		63^{35}										
Goodwin Pharm.		86^{30}		86^{30}								
NWREL		8^{41}										
Conference Expenses												
L. Morehouse		15^{28}										
VIP's Restaurant		12^{97}										
J.L. Morehouse		6^{54}										
S. Kannenberg		16–										
D. Hunter		6^{92}										
J. Beier		5^{50}										
D. Hunter		4^{60}										
Rose's Restaurant		20 –										
Petty Cash		3^{62}										
Petty Cash		8^{43}										
Petty Cash		15^{12}										
Petty Cash		5^{22}										
Printed Material												
Petty Cash		3^{45}		3^{45}								
Petty Cash		8^{95}		8^{95}								

CHART II: Assignment of NWREL CE_2 Costs to ARIES

Standard Categories

	Total for Prorated Items	CE_2 Allocation	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
993 - 0930: (Continued)												
Other Supplies												
Kilhams Stationery		20^{42}		20^{42}								
Fred Meyer		29^{20}		29^{20}								
NWREL		11^{03}		11^{03}								
Petty Cash		4^{89}		4^{89}								
Petty Cash		2^{69}		2^{69}								
Petty Cash		2^{39}		2^{39}								
Petty Cash		6^{86}		6^{86}								
Petty Cash		2^{50}		2^{50}								
Petty Cash		2^{07}		2^{07}								
Subcontracts & Agree.												
Portland Comm. Coll.		87^{50}		87^{50}								
Portland Comm. Coll.		68-		68-								
Portland Comm. Coll.		20^{50}		20^{50}								
Portland Comm. Coll.		20-		20-								
Portland Comm. Coll.		57-		57-								
993 - 0940: CE_2												
Operations - Logistics												
Salaries and Benefits												
Part-time Employees		560-		560-								
Staff Travel												
L. Morehouse		111^{02}		111^{02}								
D. Hunter		39^{21}		39^{21}								
D. Hunter		28^{60}		28^{60}								
Petty Cash		0^{60}		0^{60}								
Other Travel												
Phylis Pratt		72-		72-								
R. Sullivan		48^{15}		48^{15}								
King City Arco		301-		301-								
P. Pratt		49^{90}		49^{90}								
R. Sullivan		45^{75}		45^{75}								
P. Pratt		53^{60}		53^{60}								
P. Pratt		27^{90}		27^{90}								
R. Sullivan		53^{65}		53^{65}								

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CHART II: Assignment of ARIES
CE$_2$ Costs to ARIES
Standard Categories

		Total for Prorated Items	CE$_2$ Allocation	Design	Application	Evaluation	Product Finishing	Documentation	Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Admin., Etc.
998 - 0940: (Continued)													
Other Travel (Continued)													
P. Pratt			8^{40}		8^{40}								
P. Pratt			26^{60}		26^{60}								
P. Pratt			52^{10}		52^{10}								
R. Sullivan			48^{40}		48^{40}								
Petty Cash			0^{50}		0^{50}								
Petty Cash			2^{75}		2^{75}								
Transportation of Things													
Postmaster			2-		2-								
Postmaster			2^{05}		2^{05}								
Other Services													
Sears Roebuck			61^{81}		61^{81}								
Telephone			34^{41}										
Subcontracts & Agree													
Knauss Chevrolet			112^{60}		112^{60}								
998 - 0950: CE$_2$													
Operations - Fixed Costs													
Subcontracts & Agree													
All States Leasing			89^{91}										
Program													
R. Sullivan			10^{50}										
Nelsen Tire			61^{67}										
Petty Cash			1^{93}										
Refund Check #1110			$- 0^{78}$										
CE$_2$ Totals			19641^{71}	3898^{76}	14752^{55}	0-	0-	0-	500^{04}	490^{36}	0-	0-	0-
NWREL Column Totals	10672^{24}	4226^{26}	44097^{99}	2527^{26}	$- 17^{32}$	7791^{28}	4231^{76}	832^{16}	3507^{75}	6170^{26}	295^{54}	303^{19}	3551^{61}
CE$_2$ & NWREL	10672^{24}	4226^{26}	63739^{70}	6426^{02}	14735^{23}	7791^{28}	4231^{76}	832^{16}	4007^{79}	6660^{62}	295^{54}	303^{19}	3551^{61}
Rent Reserve			18041^{12}										
Total NWREL			81780^{82}										
Per Cent of line 35				10.08	23.12	12.22	6.64	1.31	6.29	10.45	0.46	0.48	5.58
Rank				4	1	2	5	8	6	3	10	9	7

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CHART III

Costs Directly Apportioned To ARIES' Standard Report Categories

Category	Cost Apportionment	Percent	Rank
Design	6,426.02	10.1	4
Application	14,735.23	23.1	1
Evaluation	7,791.28	12.2	2
Product Finishing	4,231.76	6.6	5
Documentation	832.16	1.3	8
Diffusion	4,007.79	6.3	6
Fundor Negotiation & Liaison	6,660.62	10.5	3
Site Negotiation & Liaison	295.54	0.5	10
Staff Recruitment & Training	303.19	0.5	9
General Clerical Administration and Housekeeping	3,557.61	5.6	7

No allocation of NWREL Operational Costs were made to ARIES suggested program component categories, since CE_2 staff were not available for interview.

Even had they been so, it would be apparent that refinement based on memory would be meaningless. The categories suggested by ARIES are admitted to be a best first approximation only. Their application in practice would require extensive interaction with staff. In the process categories and definition would change. A hasty interview, even if permitted, would not allow for this process. At best the results could only be extremely rough approximations. In any case, the interviews were not permitted.

Based on this data at hand, ARIES has derived estimates of the annual per pupil operational costs. These are derived from costs as reported in Chart II. The following Chart IV shows the process.

CHART IV

Lower and Upper Estimates of Operational Costs of EBCE at NWREL's CE_2

	Item	(1) Design	(2) Application	(3) Evaluation	(4) Staff Recruitment & Training Plus Gen. Adm. SRT/GA
1)	CE_2	3,899	14,753	0	0
2)	NWREL		-17		3,557
3)	NWREL Allocations				
	(a) Facility & Telephone				678
	(b) Indirect				698
4)	Total	3,899	14,736	0	4,933
5)	Allocation of SRT/GA	362	1,514	0	-1,876
6)	Total/Mo.	4,261	16,250	0	
7)	Total X9.5	40,480	154,375	0	
8)	CE_2 Rent		12,996		
9)	Equipment (Annualized)		5,000		
10)	Total Annual	40,480	172,381		
11)	Lower Estimate		172,381		
12)	Upper Estimate	212,861			

Figures from lines (1) and (2) of Chart IV, are taken from the column totals of Chart I and Chart II. Line (3) allocates the two NWREL indirect categories (Telephone and Facilities, Indirect) to SRT/GA. In line (5) a share of the total cost assigned to SRT/GA is allocated to Design, Application, and Evaluation respectively. Line (6) gives the total cost March estimate for the three Standard Categories. Assuming that March is average and that there are 9.5 months in the school year, the month figures are converted into annual figures in line 7. Rent for the CE_2 facility is recorded in line 8.

Line 9 records an annualized equipment charge. We assumed $20,000 in equipment purchased over a 5 year period. The price plus interest total cost estimate was $25,000. This figure was depreciated over a five year period giving $5,000.

Line (10) records the totals of lines (7), (8), (9). The lower estimate of annual operating costs is the application total, or $172,381. To obtain the upper estimate, Design plus Evaluation for CE_2 staff is added. This is found in column (1) line (10). The upper estimate is $212,851 found in line (12).

These are converted into per pupil annual costs in Chart V. We assume no increase in cost for student enrolments beyond 64. This is simply ARIES informed judgment.

It should be noted that CE_2 enrolment was 50 students for school year 73-74, and that CE_2 plans an enrolment of 64 for 74-75. ARIES feels that present staff size and facility cost could accomodate enrolments in the range of 75 to 100 if all research and development activities were present.

It should also be admitted that all building and equipment costs have been included as an operational cost (Chart IV, line 9). If purchased outright prior to operation, these costs would be acquisition costs. The service costs of acquisition would be increased by that amount.

Finally, no adjustment has been made to account for the difference between salary and benefits paid staff in developmental project as that to staff in a adopter setting. No thorough analysis has been done, but ARIES has looked at daily compensation scales at NWREL/CE_2. These, we feel are on the average of 5% in excess of adopter staff salaries.

CHART V

Estimate of Per Pupil Annual Costs at Various Enrolments

Item	Total Cost	Enrollments			
		50	64	75	100
Lower Estimate	$172,371	$3,446	$2,701	$2,585	$1,724
Upper Estimate	$212,851	$4,257	$3,326	$3,193	$2,129

4.0 Conclusions

4.1 It is the opinion of this paper that the categories of Standard Reporting make for more accurate and more useful reports. For example, in the absence of ARIES categories

(a) Costs of the same activity would be allocated among different report categories. For example, activity allocated to professional meetings would be reported to Evaluation for personal costs and to Program Administration for travel costs.

(b) Costs associated with the same significant activities for which no defined report category exists at present are reported among different activities. For example, there is no provision for classifying activity due to the reporting needs and other tasks imposed by NIE itself. Hence, the associated costs were found to be allocated to the primary category to which personnel are assigned, e.g., Product Finishing, Evaluation, etc.

(c) The large residual category of Program Administration which under current practice would account for $10,599 and 17% of cost is subdivided into three specific categories and a final residual category for better specification and analysis of cost.

4.2 The recommendation that rough estimates of per pupil employ an upper and lower estimate, the upper including Design and Evaluation in addition to Application Costs (which define the lower estimate) should be abandoned. Based on the experience of this investigation the upper estimate would be double the lower estimate. ARIES feels this range of difference is excessive. Based on the experience of NWREL analysis, the upper estimate should include the design and evaluation contribution of operational personnel only. In this case the upper estimate would exceed the lower by only 26%.

4.3 The recommendation of the prior report that proration be avoided wherever possible is amplified by the presence of what appear to be arbitrary proration schema in the CE_2 cost allocation system. Prorations of these kinds contain assumptions concerning the impact of each activity to which cost is prorated upon the behavior of costs when the level activity is changed. For example, if the proration is 20% Development, 40% Operations-Instructional System, and 40% Operations-Logistics (using NWREL categories), the implication is that in the absence of Development cost would be reduced by 20%. This may be true in some cases, for example, the quantity of duplicating paper. However, it may not be true, for example, in the case of equipment such as duplicating machinery.

4.4 In a related matter, for discussion of replication requirements and cost, the most useful data is (a) specification of the resource quantities required by the program in their physical, nonmonetary dimensions and (b) description of their allocation among various component elements of the program during the annual (or other) cycle of operation. If this is done the adopter of the program is free to exercise his own judgments concerning full or partial utilization of resources and the associated costs based upon his own particular site conditions.

4.5 One staff suggestion was that evaluation be viewed as a product instead of an activity only. In this case NIE would report the costs of design, application and evaluation, etc., of evaluation. This suggestion, on the part of evaluation personnel should be given consideration, since by inclusion one gives specific recognition to the importance of evaluation as an operational activity.

4.6 One recommendation has nothing to do with the NWREL cost system. NWREL staff reported that they could only report time to those categories for which they were budgeted. This policy was ascribed to NIE. Such a policy either promotes inefficient operations or inaccurate reporting. Staff should be free to report their time to categories which most accurately describe their actual work. A policy which requires otherwise should be changed.

4.7 Finally, NIE must require specification cost collection system in the early stages of research and development programs. This will mean that cost questions be clearly formulated early in the project. It is too often the case that cost matters are left until late in the lifetime of the program. The result is that cost questions are unanswered and/or that new reporting requirements are imposed.

It will usually be the case that such a system will be considerably more detailed than those now employed. Such a system may be thought foreign to educational researchers and onerous to their staff. However, it is likely to achieve better acceptance in the long run since staff will be freed from adjusting to the continual introduction of new systems of increased detail. Such a more detailed system will, of course, be much more adequate to providing the kind of cost information ultimately desired.

EXHIBIT A

EXHIBIT A

Cost Category Translation Matrix

The chart which follows indicates the relationships between the categories used by NWREL, NIE, and ARIES. The basic ARIES categories which describe research and development are listed as headings to columns 2 through 11. NWREL and NIE categories are listed vertically. So too are ARIES product and product component categories. For each non-ARIES term listed as a row heading an indication is given in column one which identifies the system of origin. For any non-ARIES row heading, a circle in a column heading indicates that the row term is classified or divided among the column headings so indicated. If ARIES product or product component categories apply, those appropriate will be listed under the NWREL/NIE term in the left hand margin. It should be understood that this always implies that the quantities transposed into ARIES research and development categories be further divided into appropriate ARIES product and product component categories. This will be indicated by a downward directed arrow.

TRANSLATION Pg 1/5
MATRIX

	System	Design	Application	Evaluation	Product Finishing	Documentation	Replication/Diffusion	Funder Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Adm, Clerical Housekeeping
Primary Product											
Development - NWREL	NWREL										
Governance	NWREL	○									
Recruitment	ARIES										
Operation	ARIES										
Management	NWREL	○									
EBCE Program Adm.	ARIES										
Basic Student Support	ARIES										
Transportation	ARIES										
Insurance	ARIES										
Health Services	ARIES										
Other - Specify	ARIES										
Instructional System	NWREL	○									
Execution	ARIES										
Exploration Level	ARIES										
Basic Skills	ARIES										
Life Skills	ARIES										
Career Develop't	ARIES										
Learning Level	ARIES										
Basic Skills	ARIES										
Life Skills	ARIES										
Career Develop't	ARIES										
Specialization Level	ARIES										
Basic Skills	ARIES										
Life Skills	ARIES										
Career Develop't	ARIES										
Special Placement	ARIES										
Basic Skills	ARIES										
Life Skills	ARIES										
Career Develop't	ARIES										
Guidance	NWREL	○									
Orientation	ARIES										
Long Range Planning	ARIES										
Short Range Planning	ARIES										
Progress Monitoring & Assessment	ARIES										
Student Personal Affairs and Problems	ARIES										

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TR-MATRIX pg 2/5

	System	Design	Application	Evaluation	Product Finishing	Documentation	Replication Diffusion	Funder Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Adm, Clerical Housekeeping
Development - NWREL											
Employer Utilization	NWREL	→○									
Recruitment, Analysis & Development	ARIES	↓									
Maintenance	ARIES	↓									
CE₂ Development	NWREL										
Governance	NWREL	→○									
Recruitment	ARIES	↓									
Operation	ARIES	↓									
Management	NWREL	→○									
EBCE Program Adm.	ARIES	↓									
Basic Student Support	ARIES	↓									
Transportation	ARIES	↓									
Insurance	ARIES	↓									
Health Services	ARIES	↓									
Other - Specify	ARIES	↓									
Instructional System	NWREL	→○									
Execution	ARIES	↓									
Exploration Level	ARIES	↓									
Basic Skills	ARIES	↓									
Life Skills	ARIES	↓									
Career Devel'p	ARIES	↓									
Learning Level	ARIES	•									
Basic Skills	ARIES	↓									
Life Skills	ARIES	↓									
Career Devel'p	ARIES	↓									
Specialization Level	ARIES	•									
Basic Skills	ARIES	↓									
Life Skills	ARIES	↓									
Career Devel'p	ARIES	↓									
Special Placement	ARIES	•									
Basic Skills	ARIES	↓									
Life Skills	ARIES	↓									
Career Devel't	ARIES	↓									
Guidance	NWREL	→○									
Orientation	ARIES	↓									
Long Range Planning	ARIES	↓									
Short Range Planning	ARIES	↓									
Progress Monitoring & Ass'mt	ARIES	↓									
Stud. Personal Affairs & Prob.	ARIES	↓									

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TR MATRIX Dy 3/5

	System	Design	Application	Evaluation	Product Finishing	Documentation	Replication Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment + Training	General Adm, Cler Housekeeping
CE₂ Development											
Employer Utilization	NWREL	→○									
Recruitment, Analysis & Devel't	ARIES	↓									
Maintenance	ARIES	↓									
Evaluation											
Governance	NWREL			→○							
Recruitment	ARIES			↓							
Operation	ARIES			↓							
Management	NWREL			→○							
EBCE Program Adm.	ARIES			↓							
Basic Student Support	ARIES			↓							
Transportation	ARIES			↓							
Insurance	ARIES			↓							
Health Services	ARIES			↓							
Other - Specify	ARIES			↓							
Instructional System	NWREL			→○							
Execution	ARIES			↓							
Exploration Level	ARIES			↓							
Basic Skills	ARIES			↓							
Life Skills	ARIES			↓							
Career Development	ARIES			↓							
Learning Level	ARIES			↓							
Basic Skills	ARIES			↓							
Life Skills	ARIES			↓							
Career Development	ARIES			↓							
Specialization Level	ARIES			↓							
Basic Skills	ARIES			↓							
Life Skills	ARIES			↓							
Career Development	ARIES			↓							
Special Placement	ARIES			↓							
Basic Skills	ARIES			↓							
Life Skills	ARIES			↓							
Career Development	ARIES			↓							
Guidance	NWREL			→○							
Orientation	ARIES			↓							
Long Range Planning	ARIES			↓							
Short Range Planning	ARIES			↓							
Progress Monitoring & Assmt.	ARIES			↓							
Student Personal Affairs & Problems	ARIES			↓							

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TR MATRIX Dg 4/5

	System	Design	Application	Evaluation	Product Finishing	Documentation	Replication Diffusion	Fundor Negotiation & Liaison	Site Negotiation Liaison	Staff Recruitment & Training	General Adm, Coord; Housekeeping
Evaluation (Continued)											
Employer Utilization	NWREL			→○							
Recruitment, Analysis & Devel.	ARIES			○							
Maintenance	ARIES			○							
Operations	NWREL		→○								
Enabling	NIE		→◎								
Student Recruitment	ARIES		○								
Staff Recruitment & Trng	ARIES		○								
Staff Orientation	ARIES		○								
Student Orientation	ARIES		○								
Community Orientation	ARIES		○								
Employer Recruitment & D+D	ARIES		○								
Recruitment Anal, Devel											
Instructional System Execution	NIE		→⊙								
Basic Skills	ARIES		■ ●								
Exploration Level	ARIES		↓								
Learning Level	ARIES		↓								
Specialization Level	ARIES		↓								
Special Placement	ARIES		↓								
Life Skills	ARIES		●								
Exploration Level	ARIES		↓								
Learning Level	ARIES		↓								
Specialization Level	ARIES		↓								
Special Placement	ARIES		↓								
Career Development	ARIES		●								
Exploration Level	ARIES		↓								
Learning Level	ARIES		↓								
Specialization Level	ARIES		↓								
Special Placement	ARIES		↓								
Guidance	ARIES		●								
Long Range Planning	ARIES		↓								
Short Range Planning	ARIES		↓								
Progress Monitor/Assmt	ARIES		↓								
Student Personal Aff & Prob	ARIES		↓								
Logistics	NIE		→⊙								
Direct Support Services	ARIES		●								
Transportation	ARIES		↓								
Insurance	ARIES		↓								
Health Services	ARIES		↓								
Other-Specify	ARIES		↓								
Program Administration	NIE		→⊙								

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TR MATRIX Pg 5/5

	System	Design	Application	Evaluation	Product Finishing	Documentation	Replication Diffusion	Fundor Negotiation & Liaison	Site Negotiation & Liaison	Staff Recruitment & Training	General Adm Clerical Housekeeping
NWREL Dissemination	NWREL						→○	→○			
CE_3 Dissemination	NWREL						→○	→○			
Product Development	NWREL					→○					
Program Administration	NWREL							→○	→○	→○	→○
Documentation	NWREL				→○						
Secondary Products											
Cost Studies											
Student Recruitment	ARIES		↑ →○								
Testing											
- Special Study I	ARIES										
Community Res Costs											
- Special Study II	ARIES										
Service Modification Costs											
- Special Studies III	ARIES										
Installation Study											
- Special Study IV	ARIES										
Replication											
Prospectus	NIE										
Phase I	NIE										

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EXHIBIT A

Cost Category Relations

The pages which follow describe the relations between NWREL categories and ARIES categories. In that sense, the contents are a companion document to the Matrix. However, this document indicates which material is available from present cost records and which must be gained from interviews. Material that can be transposed from one NWREL category to one ARIES category requires only an analysis of available cost record. Material that must be transposed from one or more NWREL categories to one or more ARIES categories will generally require interviews in order to make the divisions required under the ARIES system.

In each case, the discussion is organized with NWREL categories as the starting point. For each NWREL category, an instruction is given for translation into the ARIES category or categories which describe research and development activity. Then a second instruction is given for translation into ARIES product and product component activities. The basis of whether cost records and interviews are required in order to execute the instruction is given below:

(CR) Indicates that translation to the ARIES category can be accomplished on the basis of present original cost records.

(I) Indicates that the present data will need to be divided into, or among, several categories and that interviewing will be necessary.

A. Development - Governance

Allocations to this category are to be transcribed directly into the ARIES categories of DESIGN - GOVERNANCE (CR)

However, these allocations should be detailed into those of

(I)
1. FORMATION OF THE GOVERNANCE UNIT AND RECRUITMENT OF MEMBERS
2. UNIT OPERATION

B. Development - Management

Allocations to this category transcribe directly into DESIGN (of EBCE Program Administration. (CR)

One problem is that the NIE system maintains a category for Logistics (which in turn contains (a) transportation, (b) insurance and legal service, (c) health services, (d) phone and utilities, and (e) other, to be specified) under operations. No such category(s) exist under NWREL's Development or Evaluation. Are we to believe that these services were neither designed nor evaluated? If they are, then when under NWREL Development do they find a place? Management? If so, then NWREL Management will have to be detailed as follows:

(I)
1. EBCE PROGRAM ADMINISTRATION
2. BASIC STUDENT SUPPORT SERVICES
    a. TRANSPORTATION
    b. INSURANCE
    c. HEALTH SERVICES
    d. OTHER - SPECIFY

C. Development - Instructional System
Allocations to this category transcribe directly into DESIGN - BASIC SERVICES - EXECUTION. (CR)

However these allocations should be detailed into

(I)
1. EXPLORATION LEVEL
    a. BASIC SKILLS
    b. LIFE SKILLS
    c. CAREER DEVELOPMENT
2. LEARNING LEVEL
    a. BASIC SKILLS
    b. LIFE SKILLS
    c. CAREER DEVELOPMENT
3. SPECIAL PLACEMENT (SINGLE OBJECTIVE)
    a. BASIC SKILLS
    b. LIFE SKILLS
    c. CAREER DEVELOPMENT
4. SPECIALIZATION LEVEL
    a. BASIC SKILLS
    b. LIFE SKILLS
    c. CAREER DEVELOPMENT

D. Development - Guidance
Allocations to this category transcribe directly into DESIGN - BASIC SERVICES (CR)

However, these allocations should be detailed into:

(I)
1. ORIENTATION
2. LONG RANGE PLANNING
3. SHORT RANGE PLANNING
4. PROGRESS MONITORING AND ASSESSMENT
5. STUDENT PERSONAL AFFAIRS AND PROBLEMS

E. Development - Employer Utilization

Allocations to this category transcribe directly into DESIGN (CR)

However, these allocations should be detailed into COMMUNITY RESOURCES.

(I) 1. RECRUITMENT, ANALYSIS AND DEVELOPMENT
    2. MAINTENANCE

RECRUITMENT, ANALYSIS, AND DEVELOPMENT refers to all activities involved with securing initial participation of community resources, with subsequent analysis of their enterprise in terms of its potential, with identification of specific individuals, but not including the activities specific to designing and negotiating specific projects for known students (other than required recruitment of a new employer to satisfy such a need.

MAINTENANCE refers to all activies involved obtaining the continued commitment of the resource to the EBCE program.

F. CE_2 Development

This should be assigned as ARIES DESIGN. It should be detailed as 1-5 above.

G. Evaluation

Allocations to this category transcribe to an ARIES category of the same name, EVALUATION (CR).

However, we should seek to allocate the total allocation effort among the objects of evaluation. These will include:

1. Governance (CR). Divide into:
   (I) a. FORMATION AND RECRUITMENT
       b. UNIT OPERATION
2. Management (CR). Divide into:
   (I) a. ADMINISTRATION OF PROGRAM
       b. BASIC STUDENT SUPPORT SERVICES
          (1) TRANSPORTATION
          (2) INSURANCE (STUDENT)
          (3) HEALTH SERVICES
          (4) OTHER - SPECIFY
3. Instructional System (CR). Divide into:
   (I) a. EXPLORATION LEVEL
          (1) BASIC SKILLS
          (2) LIFE SKILLS
          (3) CAREER DEVELOPMENT
       b. LEARNING LEVEL
          (1) BASIC SKILLS

(2) LIFE SKILLS
(3) CAREER DEVELOPMENT
c. SPECIAL PLACEMENT (SINGLE OBJECTIVE)
(I) (1) BASIC SKILLS
(2) LIFE SKILLS
(3) CAREER DEVELOPMENT
d. SPECIALIZATION LEVEL
(1) BASIC SKILLS
(2) LIFE SKILLS
(3) CAREER DEVELOPMENT

4. Guidance (CR) Divide into:
a. ORIENTATION
b. LONG RANGE PLANNING
(I) c. SHORT RANGE PLANNING
d. PROGRESS MONITORING AND ASSESSMENT
e. STUDENT PERSONAL AFFAIRS AND PROBLEMS

5. Employer Utilization - Community Resources (CR)
Divide into:
(I) a. RECRUITMENT, ANALYSIS, AND DEVELOPMENT
b. MAINTENANCE

H. Operations

All allocations to this category transcribe to the ARIES category of APPLICATION (CR).

NIE has established subcategories within operations. They are considered in order:

1. Enabling (I)
a. Staff and Student Selection (I)
This NIE category must be divided into:
(1) Student Selection which is to be assigned to ARIES APPLICATION and
(I) then to STUDENT RECRUITMENT within that.
(2) Staff Selection which is to be assigned to ARIES STAFF RECRUITMENT AND TRAINING.

b. Staff, Student and Community Orientation (I)
This NIE category must be divided into:
(1) Staff Orientation is assigned to the ARIES category of STAFF RECRUITMENT AND TRAINING
(I) (2) Student Orientation is to be assigned to the ARIES category of STUDENT ORIENTATION.
(3) Community Orientation - (This needs to be defined. My thought is that this is to be assigned as the ARIES category of SITE NEGOTIATION AND LIAISON.)

c. Employer Recruitment, Orientation and Development (I)
This category is to be assigned to the ARIES category of COMMUNITY RESOURCES - RECRUITMENT, ANALYSIS, AND DEVELOPMENT.

2. Instructional System (I)
This category of activity is to be assigned as the ARIES category of APPLICATION. It should be divided into:

a. EXPLORATION LEVEL
    (1) BASIC SKILLS
    (2) LIFE SKILLS
    (3) CAREER DEVELOPMENT
b. LEARNING LEVEL
    (1) BASIC SKILLS
    (2) LIFE SKILLS
(I) (3) CAREER DEVELOPMENT
c. SPECIAL PLACEMENT
    (1) BASIC SKILLS
    (2) LIFE SKILLS
    (3) CAREER DEVELOPMENT
d. SPECIALIZATION LEVEL
    (1) BASIC SKILLS
    (2) LIFE SKILLS
    (3) CAREER DEVELOPMENT

3. Logistics (I)
This category is to be divided into the ARIES category of DIRECT SUPPORT SERVICES within APPLICATION (I).
Phone and utilities are to be deleted as categories of service or component activities. These are resources and are to be assigned wherever possible.

4. Major Fixed Costs
This category is not to be defined as a service category. It may or may not be allocated as a resource among the several categories of service and function.

5. Program Administration (Operations)
This NIE category is to be assigned to the ARIES category of EBCE PROGRAM ADMINISTRATION under APPLICATION. (CR)

I. NWREL Dissemination
Allocations to this category transcribes two activities:

(I) 1. REPLICATION/DIFFUSION
2. FUNDOR NEGOTIATION AND LIAISON

Dissemination is a NWREL category which means simply talking with and rendering services to outside visitors.
FUNDOR NEGOTIATION AND LIAISON (FN & L) is an ARIES category (see Report, p.36) which refers to activity imposed on the contractor by the fundor but which does not pertain directly to accomplishment of the research and development project. Preparing progress reports, negotiations concerning nature of work, and assisting NIE contractors are

all illustrative. In the case of EBCE, Dissemination is considered as FN & L when visitors are NIE, NIE contractors, or government agents whose duties are derived from NIE (e.g., G.A.O. audits). REPLICATION/DIFFUSION is an ARIES category. (see Report, p.36) It encompasses all activity directed toward facilitating adoption of the program or materials under development. NWREL Dissemination will be classified as Replication/Diffusion when it involves persons and agencies other than those directly associated with the fundor.

J. CE$_2$ Dissemination

Allocations to this category are to be treated as NWREL Dissemination (I).

K. Product Development

This NWREL category transcribes directly into the ARIES category of DOCUMENTATION. (CR)

L. Program Administration (CE$_2$ + NWREL)

This category should be divided among four ARIES categories:

(I)
1. FUNDOR NEGOTIATION AND LIAISON
2. SITE NEGOTIATION AND LIAISON
3. STAFF RECRUITMENT AND TRAINING
4. GENERAL MANAGEMENT, CLERICAL AND HOUSEKEEPING

The following are NWREL categories that may or may not be assigned to the services and functions of the EBCE program. In ARIES terminology they may be secondary research and development products.

M. Cost Studies

1. Student Recruitment (by School District resources). This should be assigned to the ARIES category of APPLICATION and, within that, to Student Recruitment (I).
2. Testing of Control Group Students. Allocation of these resources should be assigned to ARIES category, SECONDARY PRODUCT: SPECIAL STUDY I (I) (This is an issue. An alternative is to assign to Evaluation.)
3. Study of Community Resource Costs. These resources should be assigned to SECONDARY PRODUCT: SPECIAL STUDY II (I)
4. Service Modification Cost Study. These resources should be assigned to SECONDARY PRODUCT: SPECIAL STUDY III (I)
5. Installation Study. These resources should be assigned to SECONDARY PRODUCT: SPECIAL STUDY IV (I).

N. Replication

1. Prospectus
   This category should be assigned to ARIES category, FUNDOR NEGOTIATION AND LIAISON (CR)
2. Phase I
   This category should be assigned to ARIES category, REPLICATION/DIFFUSION (CR).

Definitions

A. LONG RANGE (PROGRAM) PLANNING
Activity associated with assembly of baseline data (tests, student records, interviews), and its employment in order (1) to determine goals for program completion and beyond that for career progress (2) to assess the initial state of the student with respect to program and life goals, and (3) to choose a tentative sequence of actions which, over the period of the program, will maximize student progress toward goals so specified.

B. SHORT RANGE PLANNING
Activity associated with assembly of data and its employment in order to determine goals for the school period (semester or quarter) and choose a sequence of action, complete with detailed specification of the next immediate steps, which will maximize student progress over the school period.

C. EXECUTION
Those actions taken by staff to implement short range plan by negotiating learning tasks facilitating student placement in learning environments, and rendering assistance and guidance in task completion.

D. PROGRESS MONITORING AND ASSESSMENT
That activity taken to collect information needed for determining student progress in accomplishing specific tasks and to employ the data so gathered in evaluating student progress toward short term and program goals.

E. PERSONAL AFFAIRS AND PROBLEMS
Those activities specifically taken to identify and improve student personal problems and their effects.

F. See Pages 27 - 30 of Final Report. (Revised)

Schematic Description of Work

The diagram which follows summarizes the work flow required to accomplish the task suggestion by NIE. Assuming choice of an appropriate period of study, the first step is to break costs down into the resources allocated to the period by NWREL category. This can be done by working through the present NWREL system: One can start with reports for the period, secure a printout identifying transactions for the period by NWREL category. Such a printout permits identification of the source documents, such as time sheets. Each document states the NWREL account to which it was charged (there may be more than one). The result is a statement of physical allocation to NWREL category.

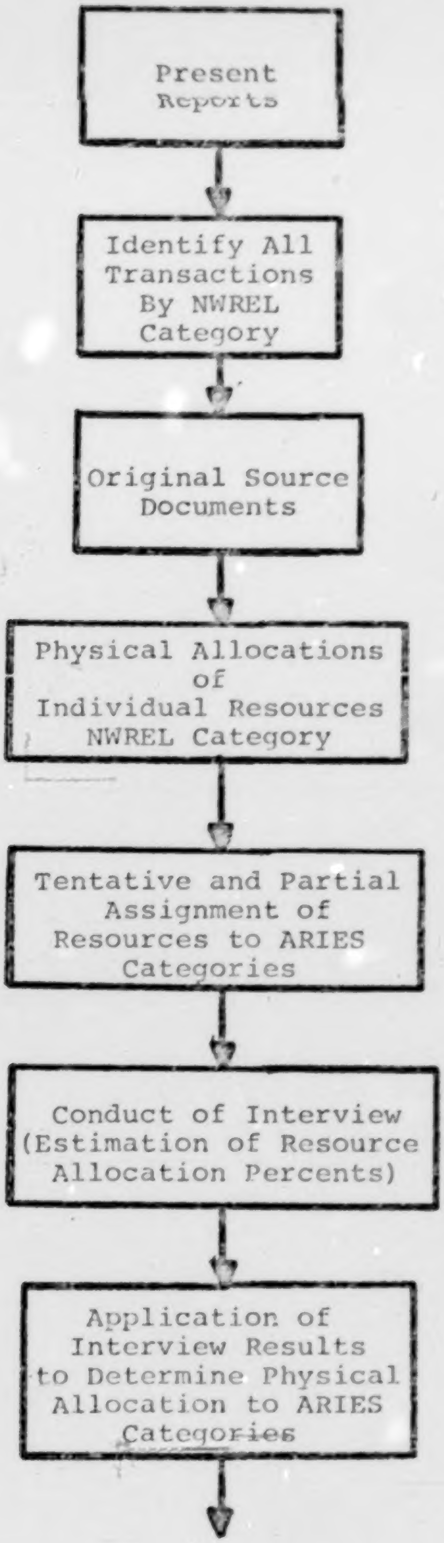
The task is to reorganize these into ARIES categories. To do so, the allocation rules displayed in the Cost Translation Matrix and stated in Cost Category Relations are applied. Some categories transpose in a one to one basis. Such a transposition results in a partial assignment into ARIES categories.

In order to complete the allocation into ARIES categories, interviews will need to be conducted. Based upon these, a final statement of resource allocations to ARIES categories can be produced. Through application of any set of wages and prices, those actual to NWREL are those representative of adopter expectations, the final distribution of cost can be determined. From that, estimates of operational cost can be provided and compared to existing estimates.

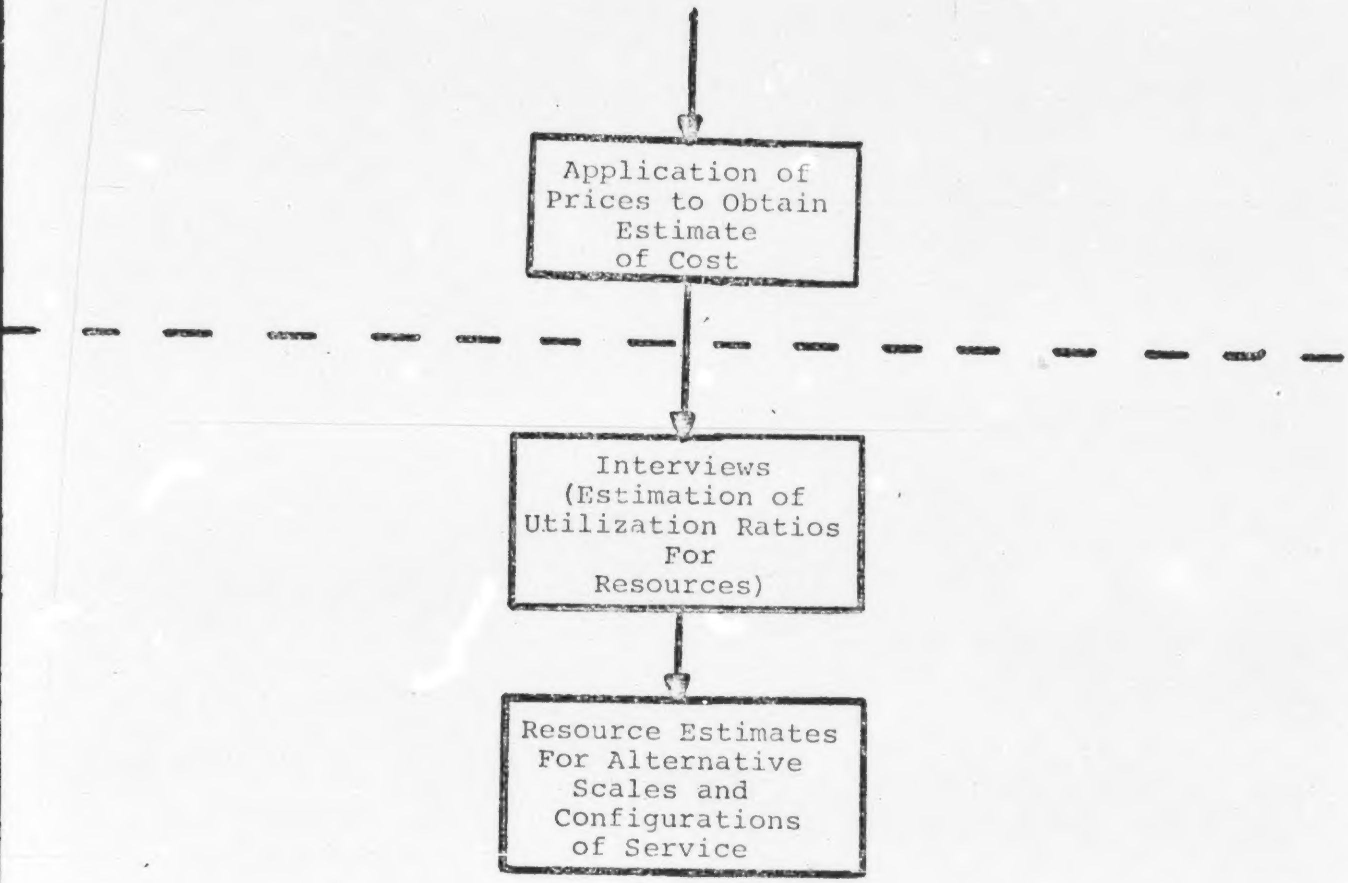
If one wishes to go further and attempt estimates at changed scales or configurations of operation, it will be necessary to determine the optimal ratios of resources to one another and/or the upper and lower (a range) of ratio values judged as acceptable.

This data either must be incorporated into the initial interviews or a second set of interviews must be conducted. A reduced set of people need be contacted however.

Schematic Description of Work


Present Reports
Identify All Transactions By NWREL Category
Original Source Documents
Physical Allocations of Individual Resources NWREL Category
Tentative and Partial Assignment of Resources to ARIES Categories
Conduct of Interview (Estimation of Resource Allocation Percents)
Application of Interview Results to Determine Physical Allocation to ARIES Categories

NOTE: Some minor resources will not be expresse in physical units. Instead dollar measures will be employed.


Application of Prices to Obtain Estimate of Cost
Interviews (Estimation of Utilization Ratios For Resources)
Resource Estimates For Alternative Scales and Configurations of Service

Interviews

The attached statement gives some indication of the interviews to be conducted.

A. PREPARATION
Prior to conducting any staff interview, the resource allocation to NWREL categories must be retrieved from the original documents. This information is the starting point.

B. CONDUCT OF INTERVIEW

1. We start by stating our purpose and what we found in original records. We work from the old classification through activities to the new categories.
2. My suggestion is to discuss with the individual how the subject resource (e.g., staff time) is used. Roughly, I ask, What Is It That You ~~Do~~?
3. As that is discussed, I note the kinds of activities which are mentioned and try to make associations with the generalized conceptual terms which I have already in mind.
4. I would suggest verifying the associations with the individual. We ask, Taking the meaning of the general term as follows, would you agree that what you have described is properly assigned to that term? The result is (1) a description of how the resource is employed in the terms of the person describing its use and (2) a mapping from his terms, which will differ from person to person, into our terms, which are general across the project.
5. The next step is to associate quantities with the activities discussed. Often it is preferable to require quantities expressed in the units of measure associated with the resource (e.g., hours). However, in this case, where we are recollecting over an extended period of time and that from a distant point of time, it may be more practical to seek the relative quantity - percent - of resource employment devoted to the activity.

C. APPLICATION
The quantities or the percents are compared or applied to the values found on the original documents. The estimates to be placed in our illustrative report are derived from the comparisons or applications.

D. TIME
The time required for such an interview is hard to estimate. However, for nonsupervisory staff, I would estimate 2 hours as the outside maximum.